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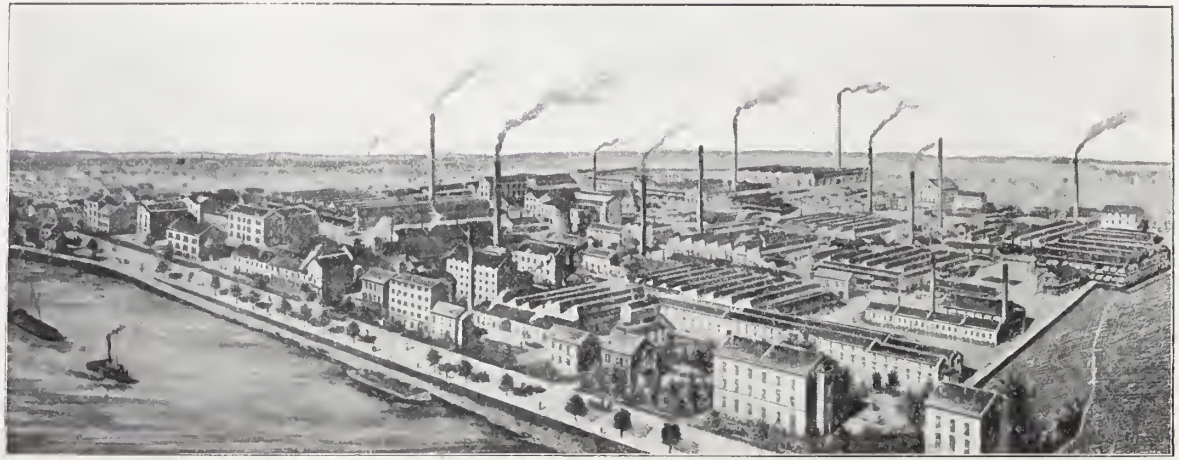
MANUFACTURE LYONNAISE DE MATIÈRES COLORANTES, LYONS.

Works "La Mouche".

RUSSIAN ANILINE COLOUR WORKS LEOPOLD CASSELLA & Cº, RIGA.

Works at Riga.

LEOPOLD CASSELLA & Cº, G. m. b. H., FRANKFORT o. M.



Works at Mainkur near Frankfort o. M.

THE PRINTING OF COTTON FABRICS

WITH THE DYESTUFFS

OF

LEOPOLD CASSELLA & Co

G. M. B. H.

FRANKFORT o. M.

PUBLISHED BY

LEOPOLD CASSELLA & Co, G. M. B. H., FRANKFORT o. M.

1905.

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PREFACE.

In our work on "Cotton Dyeing" published a few years ago, and in the Supplement thereto brought out last year, the application of our dyestuffs for the dyeing of cotton has been fully described; this present work we have devoted to the application of our products in cotton printing.

Besides the application of the Basic Colours for direct printing and tannin discharge styles and for the other important combinations, the discharge styles produced with the Diamine Colours and with the so-called "Ice Colours" call for special attention and are exhaustively dealt with accordingly, these colours having further gained very considerably in importance in cloth printing since the introduction of Hyraldite, our new discharging agent. The new group of Immedial Colours, which in printing have been adopted especially for the production of very fast pale shades, has also received due attention; Table XI shows some patterns produced with these colours in practice.

We shall be glad if you will accord to this volume a kindly reception, and in our desire to steadily improve our publications we beg to solicit a continuance of your friendly assistance by means of any information and advice you may be able to afford us from practice.

Frankfort o. M., February 1905.

Leopold Cassella & Co
G. m. b. H.

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I.

Basic Colours.

Preparation of the Goods.

A previous preparation of the cotton goods may in most cases be omitted.

If basic colours are used together with Alizarine Red and Rose, the material must be oiled before printing. This is carried out as follows:

The goods are passed through a solution of

3–5 lbs	Turkey-red oil 50%,
9 gallons	water and
5 lbs	tragacanth thickening 65:1000

in the padding machine, and then dried in the hot-flue or on drying cylinders.

Neutral oils form a clear solution in water, whilst in the case of acid oils it is advisable to add a small quantity of alkali (8 oz – 1 lb caustic soda lye of 32° Tw. per 10 gallons).

A. Direct Printing.

Basic colours are usually printed with the addition of tannin and organic acids; of the latter, acetic acid, formic acid and tartaric acid come mainly into consideration.

Tannin (quantities)

The requisite quantity of tannin is, in the first place, dependent on the depth of shade, but it is also regulated by the requirements in respect to fastness of the prints.

If small quantities are used, the shades will turn out brighter than with large quantities; the latter on the other hand give shades of better fastness to light.

The quantities of tannin usually used are 2–4 times the weight of the dyestuffs employed.

In the case of very light shades, however, the quantity of tannin should always be proportionately larger than for medium or dark shades, and may be increased to 5–6 times the weight of the dyestuff.

Effect of Acids

By adding acetic or tartaric acid, the formation of a tannin-colour lake is prevented and thus likewise the precipitation of dyestuff in the print colour.

The print colours should not be kept in warm places if they are to be preserved, and some acetic acid should be added now and again. Ethyl tartaric acid or acetine act still more favourably than acetic acid, acetine especially being frequently used together with acetic acid.

Steaming

The steaming usually lasts 1/2 hour at 1/2 atm. or 1 hour without any pressure. The most efficient way is to allow the goods to pass the small Mather & Platt previously to the actual steaming.

Antimony Bath

After steaming, the goods are passed through an antimony bath at 50° C. (120 deg F.) containing 8 oz–1 lb tartar emetic per 10 gallons liquor, or an equal quantity of the usual antimony salts.

In order to neutralise the liberated acids, 1/2–1 lb of chalk is also added.

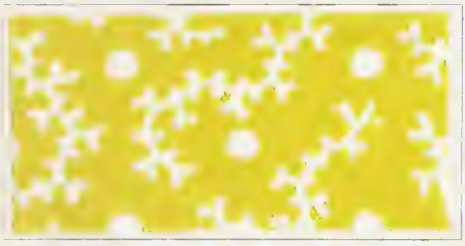
After the antimony passage, the pieces are rinsed, soaped, and chlorinated if necessary.

Thioflavine T.

Thioflavine T possesses a bright lemon-yellow shade and is very widely applied for the production of bright yellow shades as well as in combination with other basic colours for bright green and olive-yellow shades.

Thioflavine T is distinguished for its fastness to chloring, acids and severe steaming. The colour is not destroyed by tin crystals, and is therefore also well adapted as an addition to coloured discharges.

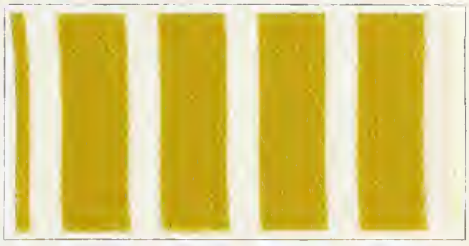
No 1.



6 parts by weight of Thioflavine T
are dissolved warm in
100 parts by weight of acetic acid of
8° Tw.,
10 parts by weight of acetine and
344 „ „ „ „ water, then
stirred up with
500 parts by weight of thickening T,
and when cold
40 parts by weight of tannin-acetic
acid 1:1 are added.

appr. 1000 parts.

No 2.



20 parts by weight of Thioflavine T
are dissolved warm in
120 parts by weight of acetic acid of
8° Tw.,
20 parts by weight of acetine and
220 „ „ „ „ water, then
stirred up with
500 parts by weight of thickening T
and when cold
120 parts by weight of tannin-acetic
acid 1:1 are added.

appr. 1000 parts.

Yellow: Thioflavine T.

Red: Irisamine G
Tannin Orange R.

Paraphosphine pat. G and R.

Paraphosphine is applied for deep yellow shades and for saddening purposes.

Paraphosphine G pat.

No 1.

Paraphosphine R pat.

No 2.

30 parts by weight of Paraphosphine G or R are dissolved warm in
150 „ „ „ „ acetic acid of 8° Tw.,
10 „ „ „ „ acetine and
160 „ „ „ „ water, then stirred up with
500 „ „ „ „ thickening TEO, and when cold,
150 „ „ „ „ tannin-acetic acid 1:1 are added.

approx. 1000 parts.

New Phosphine G pat. and Aniline Yellow.

These two colours are applied for the production or dull shades of yellow and for shading other basic colours.

New Phosphine G pat.

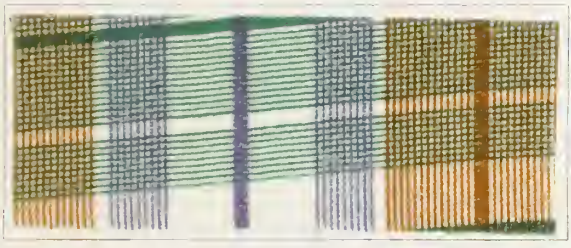
No 1.

Aniline Yellow.

No 2.

30 parts by weight of dyestuff are dissolved warm in
150 „ „ „ „ acetic acid of 8° Tw.,
10 „ „ „ „ acetine and
160 „ „ „ „ water, then stirred up with
500 „ „ „ „ thickening TEO, and when cold
150 „ „ „ „ tannin-acetic acid 1:1 are added.

approx. 1000 parts.



Dull Yellow: New Phosphine G-Print Colour No 1 reduced to 1:1.

Green: { New Methylene Blue N and Thioflavine T.

Lilac: { Irisamine G and New Methylene Blue N.

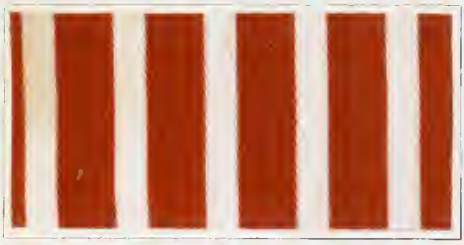
Tannin Orange pat. R and GG.

Tannin Orange R is sold both in powder and in paste form.

Both brands yield very bright shades of comparatively good fastness to light, and are used for direct printing as well as for "Illumination colours" in the production of the Aniline Black discharge styles.

Tannin Orange R pat.

No 1.



Tannin Orange GG pat.

No 2.

25	parts	by	weight	of	Tannin Orange R or GG are dissolved warm in
125	„	„	„	„	acetic acid of 8° Tw.,
10	„	„	„	„	acetine and
215	„	„	„	„	water, then stirred with
500	„	„	„	„	thickening T, and when cold
125	„	„	„	„	tannin-acetic acid 1:1 are added.

approx. 1000 parts.

Irisamine G pat.

Irisamine G is distinguished by its exceedingly brilliant shade and is used very extensively for producing bright shades of pink fixed either with tannin or with acetate of chrome. It behaves similarly to the basic Rosazeines in its resistance to washing, light and chlorine.

No 1.

5 parts by weight of Irisamine G are dissolved warm in
100 parts by weight of acetic acid of 8° Tw. and
355 parts by weight of water, then stirred with
500 parts by weight of thickening TEO, and when cold
40 parts by weight of tannin-acetic acid 1:1 are added.

appr. 1000 parts.

No 2.

20 parts by weight of Irisamine G are dissolved warm in
120 parts by weight of acetic acid of 8° Tw.,
20 parts by weight of acetine and
220 „ „ „ „ water, then stirred with
500 parts by weight of thickening TEO, and when cold
120 parts by weight of tannin-acetic acid 1:1 are added.

appr. 1000 parts.

Red: Irisamine G (No 2).

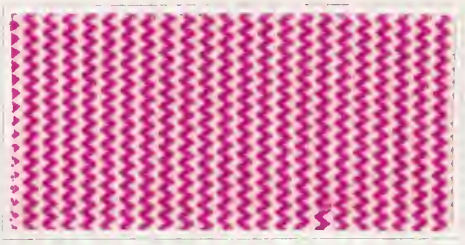
Pink: Irisamine G (No 2) reduced to 1:10.

Yellow: Thioflavine T (page 7, No 2) reduced to 1:10.

Dark Olive: New Methylene Blue N, Tannin Orange R and Thioflavine T.

Light Olive: Dark Olive, reduced to 1:10.

Irisamine G pat. with Chrome.

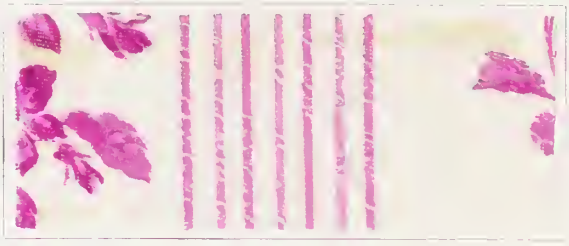


Printed on fabric prepared with Turkey-red oil.

40 parts by weight of Irisamine G are dissolved warm in
380 „ „ „ „ water, then stirred with
500 „ „ „ „ starch tragacanth thickening TO, and when cold
80 „ „ „ „ acetate of chrome of 28° Tw. are added.

approx. 1000 parts.

Steam for 1 hour without pressure, then rinse, and soap.



Red: The above print colour.

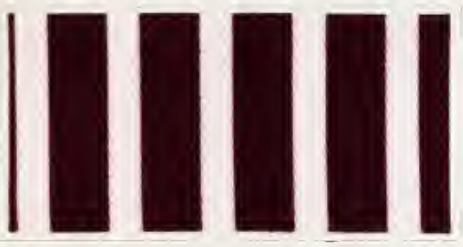
Dark Pink: The above print colour reduced to 1:1.

Light Pink: The above print colour reduced to 1:8.

Safranine.

The various brands of Safranine serve mainly for the production of dark red and claret shades; in addition they are used for shading brown and other mode shades towards red.

Safranine GGS.



10	parts	by	weight	of	Safranine GGS are dissolved in
90	„	„	„	„	acetic acid of 8° Tw.,
10	„	„	„	„	acetine and
330	„	„	„	„	water, then stirred with
500	„	„	„	„	thickening T, and when cold
60	„	„	„	„	tannin-acetic acid 1:1 are added.
approx. 1000	parts.				

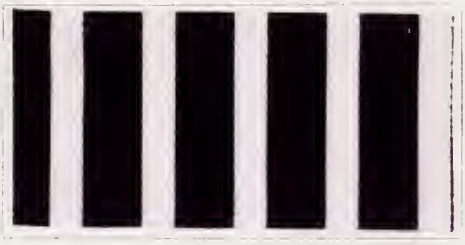
The following are the most important brands of Safranine known to the trade:

Safranine G extra 0 is used to the largest extent;
Safranine Crystals consists of pure crystallised G extra 0;
Safranine GGS is the yellowest brand;
Safranine S 150 } *give the same shade as Safranine G extra 0,*
Safranine G 140 } *but are more concentrated.*

Tannin Heliotrope.

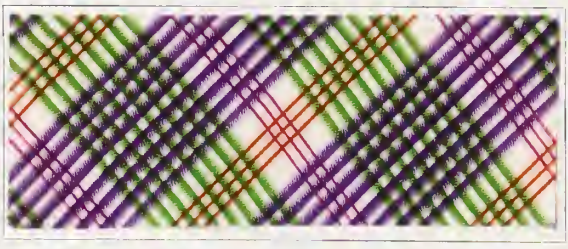
Tannin Heliotrope is used principally for heliotrope and lilac shades, and also for compound shades.

It is not quite so bright as the Methyl Violets, but is considerably superior to the latter in fastness to washing and light.



10 parts by weight of Tannin Heliotrope are dissolved in
100 „ „ „ „ acetic acid of 8° Tw. and
330 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
60 „ „ „ „ tannin-acetic acid 1:1 are added.

approx. 1000 parts.



Heliotrope: Tannin Heliotrope.

Green: Thioflavine T and Brilliant Green crystals extra.

Orange: Tannin Orange R.

Red: Irisamine G and Tannin Orange R.

Magenta.

The dyestuffs of this group are now only used for shading purposes in cotton printing, especially for claret and cutch shades.

Magenta.

15	parts	by	weight	of	Magenta small crystals are dissolved in
100	„	„	„	„	acetic acid of 8° Tw.,
20	„	„	„	„	acetine and
290	„	„	„	„	water, then stirred with
500	„	„	„	„	thickening T, and when cold
75	„	„	„	„	tannin-acetic acid 1:1 are added.

approx. 1000 parts.

The following products belong to the Magenta group:

Magenta Ia. Dia. large and small crystals;
Magenta yellow shade, which produces somewhat more yellowish shades;
Russian Red G and B, which give duller Reds than Magenta;
Geranium is a duller, more yellowish Magenta Red;
Cerise is similar to Geranium, but somewhat more bluish in cast.

Russian Red.

600 parts by weight of Standard Colour A
400 „ „ „ „ Standard Colour B.

approx. 1000 parts.

Standard Colour A.

60 parts by weight of Russian Red B are dissolved in
320 „ „ „ „ acetic acid of 8° Tw., then stirred with
320 „ „ „ „ starch tragacanth thickening T, to which
300 „ „ „ „ tannin-acetic acid 1:1 are added.

approx. 1000 parts.

Standard Colour B.

175 parts by weight of Cutch are dissolved in
150 „ „ „ „ acetic acid of 8° Tw. and
337 „ „ „ „ water, then stirred with
100 „ „ „ „ wheat starch and
125 „ „ „ „ water, and boiled. When cold,
30 „ „ „ „ Turkey-red oil,
18 „ „ „ „ chlorate of soda and
65 „ „ „ „ acetate of chrome of 28° Tw. are added.

approx. 1000 parts.

Methyl Violet.

The various brands of Methyl Violet are very largely used in cloth printing on account of their great brightness, and are very favourite shading agents in the production of navy blue, dark blue and claret shades.

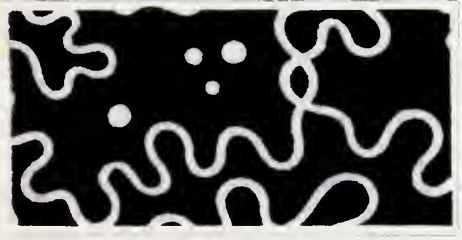
Methyl Violet 6B No I.

10 parts by weight of Methyl Violet 6B No I are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
320 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
50 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

Methyl Violet BB 72 No I.

10 parts by weight of Methyl Violet BB 72 No I are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
320 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
50 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

Methyl Violet 3R No I.



10 parts by weight of Methyl Violet 3R No I are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
320 „ „ „ „ water, then stirred with
500 „ „ „ „ starch tragacanth thickening T, and when cold
50 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

The following brands of Methyl Violet are on the market:

Methyl Violet 4R, 3R, RR, R, B, BB72, 3B, 4B, 5B, 6B.

Neutral Red and Neutral Violet.

Neutral Red and Neutral Violet have for a long time past been used regularly as shading products for all the basic colours.

Neutral Red extra.

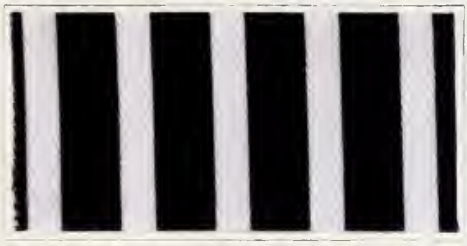
15	parts	by	weight	of	Neutral Red extra are dissolved in
120	„	„	„	„	acetic acid of 8° Tw.,
10	„	„	„	„	acetine,
4	„	„	„	„	tartaric acid solution 1:1 and
371	„	„	„	„	water, then stirred with
400	„	„	„	„	British gum 1:1, and when cold
80	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

Neutral Violet extra.

10	parts	by	weight	of	Neutral Violet extra are dissolved in
100	„	„	„	„	acetic acid of 8° Tw. and
330	„	„	„	„	water, then stirred with
500	„	„	„	„	thickening T, and when cold
60	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

Fast Neutral Violet B paste.

Fast Neutral Violet serves for producing bluish-violet shades, and possesses the advantage over the various brands of Methyl Violet of a superior fastness to light.



120 parts by weight of Fast Neutral Violet B paste are dissolved in
200 „ „ „ „ acetic acid of 8° Tw., then stirred with
500 „ „ „ „ thickening T, and when cold
180 „ „ „ „ tannin-acetic acid 1:1 are added.

1000 parts (approx.)

New Methylene Blue pat.

The various brands of New Methylene Blue are very extensively applied for producing bright direct shades of Blue, and also for shading purposes.

The following important brands are on the market:

New Methylene Blue N is the principal brand;
New Methylene Blue NSS is New Methylene Blue N free from zinc;
New Methylene Blue GB is somewhat greener than N;
New Methylene Blue NX is similar to N;
New Methylene Blue R and 3R produce bright navy blue shades;
New Methylene Blue GG is the greenest brand.

New Methylene Blue NSS pat.

7	parts by weight of New Methylene Blue NSS are dissolved in			
200	„	„	„	„ acetic acid of 8° Tw.,
10	„	„	„	„ acetine,
4	„	„	„	„ tartaric acid solution 1:1 and
409	„	„	„	„ water, then stirred to a paste with
330	„	„	„	„ British gum, and boiled; when cold,
40	„	„	„	„ tannin-acetic acid 1:1 are added.
1000	parts (approx.)			

15	parts by weight of New Methylene Blue NSS are dissolved in			
200	„	„	„	„ acetic acid of 8° Tw.,
10	„	„	„	„ acetine,
6	„	„	„	„ tartaric acid solution 1:1 and
349	„	„	„	„ water, then stirred to a paste with
340	„	„	„	„ British gum, and boiled; when cold,
80	„	„	„	„ tannin-acetic acid 1:1 are added.
1000	parts (approx.)			

New Methylene Blue GB pat.

5 parts by weight of New Methylene Blue GB pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw. and
355 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
40 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

12,5 parts by weight of New Methylene Blue GB pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
303 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
65 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

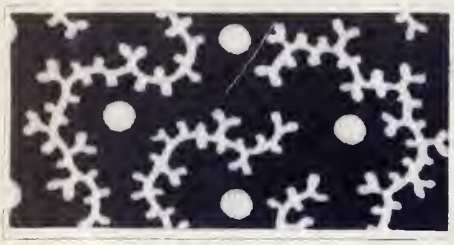
New Methylene Blue GG pat.

12 parts by weight of New Methylene Blue GG pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
10 „ „ „ „ acetine,
159 „ „ „ „ water and
4 „ „ „ „ tartaric acid (powder), then stirred with
650 „ „ „ „ parts by weight of British gum solution 1:1, and when cold
65 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

New Methylene Blue R pat.

15 parts by weight of New Methylene Blue R pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.
20 „ „ „ „ acetine and
275 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
90 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

New Methylene Blue 3R pat.



5 parts by weight of New Methylene Blue 3R pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw. and
355 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
40 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

15 parts by weight of New Methylene Blue 3R pat. are dissolved in
100 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
290 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
75 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

New Methylene Blue.

Dark Blue:	New Methylene Blue N pat.
Medium Blue:	New Methylene Blue N pat., diluted 1:6.
Light Blue:	New Methylene Blue N pat., diluted 1:15.
Pink:	Irisamine G pat.
Dark Olive:	New Methylene Blue N pat. Paraphosphine G pat. Thioflavine T pat.
Light Olive:	New Methylene Blue N pat. Paraphosphine G pat. Thioflavine T pat. — reduced.

Blue:	New Methylene Blue G B pat.
Black:	Logwood.

Dark Blue:	New Methylene Blue N pat. Methyl Violet 6B I.
Yellow:	Paraphosphine G pat.
Black:	Logwood.
Light Blue:	Victoria Blue.

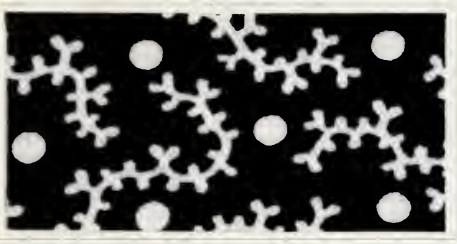
Blue:	New Methylene Blue N pat. New Methylene Blue 3R pat.
Black:	Logwood.

New Blue.

The New Blue R, D120, B and 7556 brands are used principally for printing purposes; they differ from one another only in shade and are all distinguished for their excellent fastness to light.

In combination with New Methylene Blue etc. they are extensively used for dark blue and navy blue shades.

New Blue R.



10 parts by weight of New Blue R,
10 „ „ „ „ New Methylene Blue NSS and
5 „ „ „ „ Methyl Violet BB 72 No I are dissolved in
200 „ „ „ „ acetic acid of 8° Tw.,
10 „ „ „ „ acetine,
8 „ „ „ „ tartaric acid solution 1:1 and
107 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
150 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

New Blue 7556.

14 parts by weight of New Blue 7556,
24,5 „ „ „ „ New Methylene Blue NSS and
3,5 „ „ „ „ Methyl Violet BB 72 No I are dissolved in
200 „ „ „ „ acetic acid of 8° Tw.,
20 „ „ „ „ acetine and
5 „ „ „ „ tartaric acid (powder) and
33 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold
200 „ „ „ „ tannin-acetic acid 1:1 are added.
1000 parts (approx.)

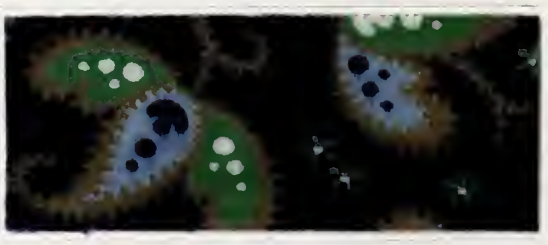
Dark Blue: New Blue 7556, New Methylene Blue NSS, Methyl Violet BB 72 No I.
Medium Blue: New Methylene Blue NSS.
Light Blue: The above medium blue colour reduced in strength.

Printing Blue H.

Printing Blue H is used with the addition of acetine for the production of dark blue shades of very good fastness to light and washing, which are usually shaded with New Methylene Blue.

Printing Blue H is sold for printing purposes both in powder and paste form.

Blue:	20 parts	by weight of Printing Blue H powder and
	5 „	„ „ „ „ Methyl Violet 5 B No I are dissolved with
	75 „	„ „ „ „ acetine,
	200 „	„ „ „ „ acetic acid of 8° Tw.,
	5 „	„ „ „ „ tartaric acid (powder) and
	340 „	„ „ „ „ water, then stirred to a paste with
	80 „	„ „ „ „ wheat starch and
	150 „	„ „ „ „ tragacanth 65:1000, and boiled; when cold,
	125 „	„ „ „ „ tannin-acetic acid 1:1 are added.
	1000 parts (approx.)	
Green:		Brilliant Green crystals extra Thioflavine T.



Dark Blue:	Printing Blue H New Methylene Blue N Tannin Heliotrope.
Medium Blue:	New Methylene Blue N.
Light Blue:	New Methylene Blue N, reduced in strength.
Green:	Brilliant Green crystals extra Thioflavine T.
Brown:	Alizarine Cutch.

Indazine M.

Indazine M behaves in printing similarly to the various Methyl Violet brands, from which it is distinguished by its considerably superior fastness to light.

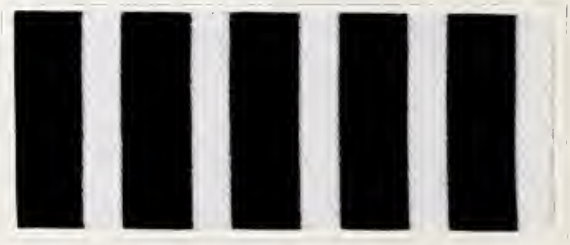
30	parts	by	weight	of	Indazine M are dissolved in
280	„	„	„	„	acetic acid of 8° Tw. and
290	„	„	„	„	water, then stirred to a paste with
85	„	„	„	„	wheat starch and
135	„	„	„	„	tragacanth 65:1000, and boiled; when cold,
180	„	„	„	,	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

Naphtindone BB pat.

Naphtindone BB pat. possesses the advantage over Printing Blue, Acetine Blue etc. of a much better solubility and of yielding very level prints. It is applied very extensively together with New Methylene Blue for the production of styles with a medium or dark indigo-coloured ground of excellent fastness to washing and light.

35 parts by weight of Naphtindone BB pat. are dissolved in
20 „ „ „ „ acetine,
210 „ „ „ „ acetic acid of 8° Tw. and
275 „ „ „ „ water, then stirred to a paste with
125 „ „ „ „ wheat starch and
45 „ „ „ „ dark burnt starch, and boiled;
at a temperature of 50° C. (120 deg. F.)
15 „ „ „ „ lactic acid are added, and, when cold,
250 „ „ „ „ tannin-acetic acid 1:1,
23 „ „ „ „ glycerine and
2 „ „ „ „ chlorate of soda.

1000 parts (approx.)



27 parts by weight of Naphtindone BB pat.,
5 „ „ „ „ New Methylene Blue N pat. and
8 „ „ „ „ Tannin Heliotrope are dissolved in
20 „ „ „ „ acetine,
230 „ „ „ „ acetic acid of 8° Tw. and
243 „ „ „ „ water, then stirred to a paste with
125 „ „ „ „ wheat starch and
45 „ „ „ „ dark burnt starch, and boiled; at 50° C. (120 deg. F.)
15 „ „ „ „ lactic acid are added, and, when cold,
250 „ „ „ „ tannin-acetic acid 1:1,
30 „ „ „ „ glycerine and
2 „ „ „ „ chlorate of soda.

1000 parts (approx.)

Methyl Indone B.

Methyl Indone B is used for producing bluish grey shades and possesses very good fastness to light.

Another more reddish brand is Methyl Indone R.

10	parts	by	weight	of	Methyl Indone B are dissolved in
245	„	„	„	„	acetic acid of 8° Tw.,
30	„	„	„	„	acetine,
4	„	„	„	„	tartaric acid solution 1:1 and
441	„	„	„	„	water, then stirred to a paste with
220	„	„	„	„	British gum, and boiled. When cold,
50	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

Brilliant Green.

Brilliant Green is applied both as a self colour and in combination with other basic colours, such as Thioflavine T, for the production of pure green shades.

5 parts by weight of Brilliant Green crystals A No I are dissolved in
100 „ „ „ „ acetic acid of 8° Tw. and
355 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold,
40 „ „ „ „ tannin-acetic acid 1:1 are added.

1000 parts (approx.)

Solid Green.

Solid Green is similar to Brilliant Green in its behaviour, but is somewhat more bluish in shade.

7,5 parts by weight of Solid Green crystals 0 are dissolved in
100 „ „ „ „ acetic acid of 8° Tw. and
353 „ „ „ „ water, then stirred with
500 „ „ „ „ thickening T, and when cold,
40 „ „ „ „ tannin-acetic acid 1:1 are added.

1000 parts (approx.)

Bismarck Brown.

Bismarck Brown is used for producing pure brown shades. To prevent as much as possible any staining of the white, it is best printed on unoiled material.

After printing, the goods are steamed for about one hour at 1/2 atm. in order to obtain a full, yellowish tone.

5	parts	by	weight	of	Bismarck Brown GG are dissolved in
100	„	„	„	„	acetic acid of 8° Tw.,
15	„	„	„	„	acetine,
5	„	„	„	„	tartaric acid solution 1:1 and
453	„	„	„	„	water, then stirred to a paste with
387	„	„	„	„	British gum, and boiled; when cold,
35	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

The following brands of Bismarck Brown are on the market:

Bismarck Brown GG is the brand most extensively used;
Bismarck Brown EE is the reddest brand;
Bismarck Brown FF is somewhat clearer in shade than EE;
Bismarck Brown PS is somewhat bluer than GG;
Bismarck Brown FFG is the most yellowish brand.

Chrysoïdine.

Chrysoïdine is used principally for shading Bismarck Brown, Brilliant Green and other basic colours; to prevent as much as possible any colouring of the white it is best printed on unoiled material.

20	parts	by	weight	of	Chrysoïdine R are dissolved with
200	„	„	„	„	acetic acid 8° Tw.,
20	„	„	„	„	acetine,
20	„	„	„	„	tartaric acid solution 1:1 and
120	„	„	„	„	water, then stirred with
500	„	„	„	„	thickening T, and when cold
120	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

The following brands of Chrysoïdine are on the market:

Chrysoïdine R is the reddest brand;
Chrysoïdine crystals dyes yellower shades and is very widely employed;
Chrysoïdine F is still yellower and brighter;
Chrysoïdine AG is the yellowest product of the group;
Chrysoïdine FN dyes the deepest shades.

B. Discharging of Basic Colours.

Discharge effects may be produced by working according to three different methods, viz:

a) By printing a caustic-lye discharge on goods mordanted with tannin and antimony and then dyeing;

b) by dyeing first and then discharging with an oxidation discharge (chlorate discharge), or

c) by dyeing first and then discharging with reducing agents (Hyraldite or tin crystals).

a) The Tannin Discharge Style.

The fabric is taken through a tannin solution at 60° C. (140 deg. F.), containing 1–4 lbs tannin per 10 gallons liquor according to the depth of shade to be dyed, dried in the hot-flue or left lying in a damp state for a few hours, then passed full width through a warm antimony bath containing 8 oz–2 lbs tartar emetic, 1 1/2–4 1/2 oz chalk or 3/4–2 1/4 oz soda ash per 10 gallons in proportion to the quantity of tannin used. The material is then thoroughly rinsed, soaped lightly if necessary, washed, and dried.

The following caustic soda lye discharge is printed on the material prepared in the above manner:

65 parts by weight of caustic soda lye of 77° Tw. are thickened with
30 „ „ „ „ burnt starch and then mixed with
5 „ „ „ „ sulphite of potash of 90° Tw.

approx. 100 parts.

Having been quickly dried, the printed goods are steamed for about 1 minute in a Mather & Platt with as dry steam as possible, or passed over a hot drying cylinder, then acidulated with diluted sulphuric acid (1° Tw.), and thoroughly washed.

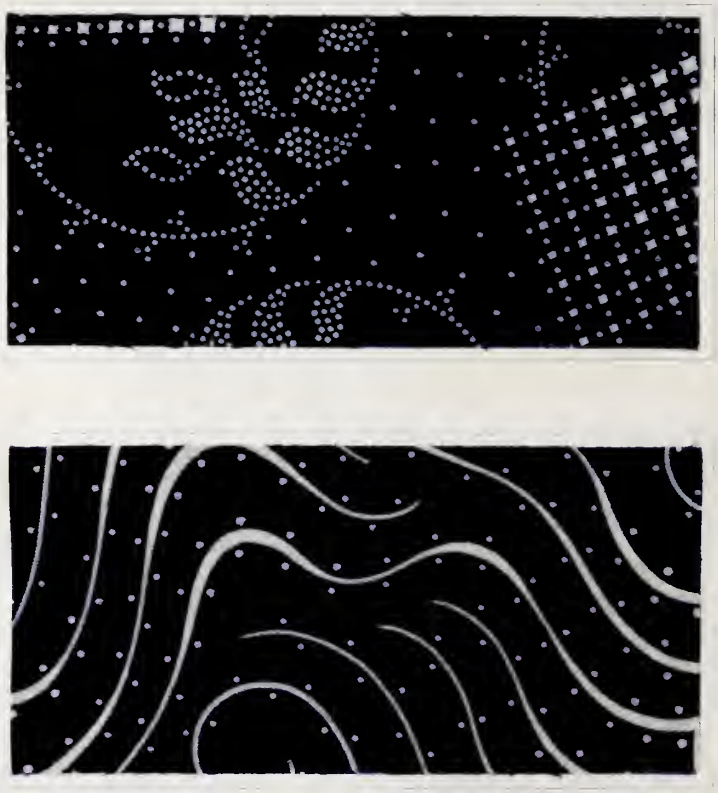
The goods are then straightway dyed in the jigger or vat by entering into the cold dye-liquor, gradually bringing it to the boil in the course of an hour, and then dyeing at the boil for another 1/4 to 1/2 hour; they are then thoroughly rinsed.

In order to obtain a good white, it is advisable to add to the dyebath about 1 gallon of a glue solution of 1:10 per 100 lbs of cotton and about 1 1/2 oz tartar emetic per 10 gallons liquor, particular care being taken that not more dyestuff is added to the dyebath than can easily be absorbed by the goods. Deeper shades may be obtained by a heavier previous mordanting of the goods; as already mentioned, an excess of dyestuff in the bath should be avoided. The white may be further improved by a passage through a weak chlorine solution.

The following basic dyestuffs are particularly well adapted for the tannin discharge style, and more especially those marked with an asterisk (*).

* *Thioflavine T pat.*
New Phosphine G pat.
Phosphine IIa
* *Phosphine Ia*
Tannin Orange R pat.
Aniline Yellow
* *Safranine, all brands*
* *Irisamine G pat.*
* *Tannin Heliotrope*
Magenta Ia Dia.
Magenta yellow shade
Cerise Ia
Neutral Violet extra
* *Methyl Violet, all brands*
* *Crystal Violet 5B*
* *New Methylene Blue, all brands*
* *New Blue, all brands*
* *Brilliant Green*
* *Solid Green*
* *Malachite Green conc.*

Of all dyestuffs, New Methylene Blue N pat. is the most important for the tannin discharge style; the following two patterns are produced with New Methylene Blue N pat.:

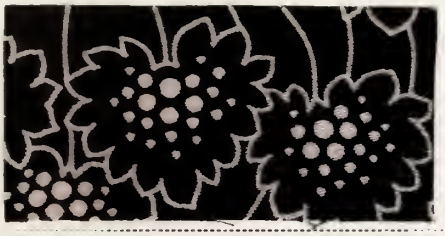


Tannin discharge style dyed with New Methylene Blue N pat.

Tannin-discharge styles, dyed with Basic Colours.

Tannin Heliotrope.

New Methylene Blue N pat.
New Methylene Blue R pat.

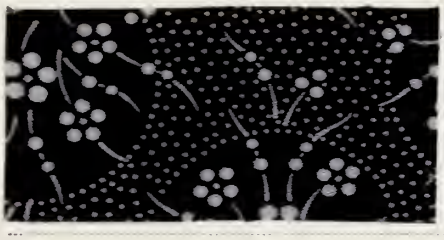


Tannin Orange R pat.
New Methylene Blue N pat.
Irisamine G pat.

Irisamine G pat.

New Methylene Blue N pat.
Thioflavine T pat.
Tannin Orange R pat.

New Methylene Blue N pat.
Tannin Heliotrope.



New Blue 7556
New Methylene Blue G G pat.

New Methylene Blue G G pat.

Discharging of the Tannin Mordant and simultaneous Reserving of Aniline Black.

As the caustic soda lye discharge by reason of its alkaline properties simultaneously reserves Aniline Black, nice effects may be obtained by printing this discharge on fabrics which have been mordanted with tannin-antimony, and subsequently printing with Aniline Black.

After passing through the Mather & Platt and subsequently rinsing, the goods are dyed with basic colours as indicated on page 31.

Semi-discharge Effects on goods dyed with Basic Colours.

The semi-discharge effects which have of late become so fashionable may be produced in different ways with basic colours.

a) By printing weak alkalies such as sodium carbonate and other soda salts, for example borax, on goods previously treated with tannin and if necessary also with tartar emetic, according to the following recipe:

30 parts by weight of soda ash are dissolved in
670 „ „ „ „ water, stirred to a paste with
300 „ „ „ „ British gum, and boiled.

1000 parts (approx.)

The goods are printed with this semi-discharge, dried, steamed for a short time in a Mather & Platt, and then dyed with basic colours.

b) By printing sulphite of potash or Hyraldite on goods dyed with basic colours and then steaming for a short time.

Semi-discharge with Sulphite of Potash.

500 parts by weight of sulphite of potash of 90° Tw. are thickened with
500 „ „ „ „ British gum 1:1.

1000 parts (approx.)

Hyraldite being the most effective, we give in the following full particulars regarding the production of the style by the application of this product.

The pieces dyed with basic colours in the usual manner are printed with the following

Semi-discharge with Hyraldite:

500 parts by weight of Hyraldite A or W are stirred to a paste with
500 „ „ „ „ British gum 1:1, heated to about 160° F. for 20 – 30 minutes, stirred until cold, and passed through a fine sieve.

The colour may be diluted with thickening according to the kind of pattern to be printed and the depth of the engravings etc.

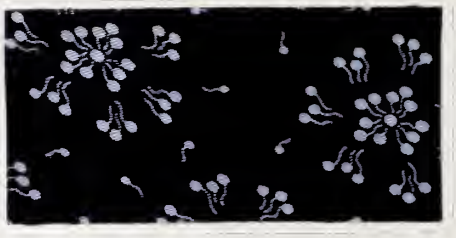
After printing, the goods are steamed for 3 – 5 minutes in a small Mather & Platt, and then rinsed.

The basic colours best suited for this style are:

Aniline Yellow
New Methylene Blue N pat.
New Methylene Blue GB pat.
New Methylene Blue NX pat.
New Methylene Blue R pat. and 3R pat.
New Blue FL and L
Methyl Violet, all brands
Solid Green, all brands
Malachite Green conc.

White effects may also be obtained along with the semi-discharge effects if the goods are discharged white as described for the tannin discharge style on page 31, then dyed, and finally printed with Hyraldite.

The following pattern has been prepared in this manner.



Dyed with New Methylene Blue N pat.

b) The Chlorate Discharge for Basic Colours.

The goods are dyed with suitable basic colours and then printed with a chlorate discharge. After printing, the goods are passed through the Mather & Platt, and rinsed.

The following basic colours may be discharged with chlorate discharge:

* *Thioflavine T pat.*
* *New Phosphine G pat.*
* *Aniline Yellow*
Phosphine IIa
* *Tannin Orange*
Irisamine G pat.
Safranine, all brands
Tannin Heliotrope
Magenta
* *Russian Red G*
* *Methyl Violet, all brands*
Neutral Red extra
Neutral Violet extra
* *New Methylene Blue R pat. and 3R pat.*
New Blue G
Printing Blue H } *in pale shades*
Indazine M }
Naphtindone BB pat. in pale and medium shades
Methylindone B and R
* *Brilliant Green crystals extra*
* *Solid Green crystals O*
* *Malachite Green conc.*
Bismarck Brown, all brands
Chrysoïdine, all brands.

The dyestuffs marked with an asterisk (*) are specially well suited for discharging.

For white, the following discharge is used:

Chlorate Discharge.

70 parts by weight of China clay are well mixed with
70 „ „ „ „ water, then
175 „ „ „ „ chlorate of soda dissolved in
240 „ „ „ „ water are added, and the whole is stirred to a paste with
250 „ „ „ „ British gum, and boiled. At about 60° C. (140 deg. F.)
125 „ „ „ „ finely powdered tartaric acid are added, and when completely cold
70 „ „ „ „ ferricyanide of ammonia solution of 42° Tw. *) are added.

1000 parts (approx.)

*) Ferricyanide of Ammonia Solution of 42° Tw.

1000 parts by weight of ferricyanide of potash are dissolved in
2000 „ „ „ „ hot water, and
700 „ „ „ „ sulphate of ammonia crystals

are added. When cold, the liquor is used after filtering from the potassium sulphate which has crystallised out.

For medium and pale shades the above chlorate discharge is correspondingly diluted with British gum thickening.

For coloured effects, non-dischargeable basic or lake colours, such as cinnabar, chrome yellow, etc., and some albumen are added. Some Diamine Colours which are fast to chloring, such as

Diamine Fast Yellow B pat.
Diamine Fast Yellow A
Diamine Yellow CP

may also be used to advantage.

c) Reduction Discharge for Basic Colours.

The following dyestuffs may be discharged with Hyraldite or tin crystals:

New Phosphine G pat.
Tannin Orange R pat.
Naphtindone BB pat.
Naphtindone T pat.

White and coloured illumination effects may be obtained with New Phosphine G and Tannin Orange R, and a very good imitation of the favourite blue and red article can be produced with Naphtindone, which is distinguished for its fastness and simple method of production.

When dyeing Naphtindone, 3—4% sulphate of alumina are first added to the dyebath and then a small portion of the dyestuff dissolved with the addition of acetic acid. The mordanted goods are entered into the cold dyebath, and the remainder of the dyestuff solution is added gradually in small portions to the tepid bath. When the bath is nearly exhausted, the temperature is gradually raised to the boil and boiling continued for 1/4—1/2 hour.

Naphtindone BB pat. discharged with tin crystals.

Red Discharge:

40	parts	by	weight	of	Irisamine G pat. and
10	„	„	„	„	Thioflavine T are dissolved in
210	„	„	„	„	acetic acid of 8° Tw., stirred in the cold with
500	„	„	„	„	acetate of tin discharge, to which
240	„	„	„	„	tannin-acetic acid 1:1 are added.
1000	parts	(approx.)			

Acetate of Tin Discharge:

675	parts	by	weight	of	acetate of tin 28° Tw.,
115	„	„	„	„	wheat starch and
210	„	„	„	„	white dextrine are boiled together.
1000	parts	(approx.)			

Tin crystals discharge A may be used instead of the acetate of tin discharge, and in this case the steaming process may be shortened or a quick Mather & Platt passage be substituted.

Tin Crystals Discharge A.

120	parts	by	weight	of	wheat starch,
400	„	„	„	„	acetate of tin of 28° Tw.,
160	„	„	„	„	white dextrine and
20	„	„	„	„	tartaric acid are boiled together; then
240	„	„	„	„	tin crystals are added, and, when cold,
60	„	„	„	„	acetate of soda.
1000	parts	(approx.)			

After printing, the goods are steamed for 1/2 hour, passed through a bath containing about 1 lb antimony salt per 10 gallons at a temperature of 60° C. (140 deg. F.) then rinsed, and dried.

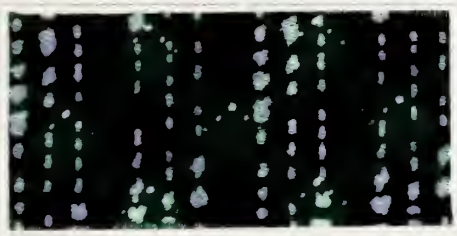
C. Reserving of Basic Colours.

Reserve Printing with Antimony Salts.

Basic colours may be reserved by means of tartar emetic or antimony salt, and this is utilised for the production of several very fashionable print styles. The fabric is first printed with the antimony reserve, then printed in the usual manner with basic colours, steamed, passed through an antimony bath, rinsed, and soaped.

The reserve is prepared in the following manner:

70	parts	by	weight	of tartar emetic are dissolved in
485	„	„	„	„ water, stirred to a paste with
350	„	„	„	„ British gum, and boiled; then
80	„	„	„	„ sulphate of zinc and
15	„	„	„	„ oxide of antimony in paste are added.
1000	parts	(approx.)		



The above pattern has been printed with the reserve described above; the Blue print was then produced with New Methylene Blue 3R, and the Green with Malachite Green conc. and Thioflavine T.

Coloured effects may also be obtained by adding Diamine Colours to the reserve.

Antimony Reserve for Coloured Discharges.

40	parts	by	weight	of any of the Diamine Colours enumerated on the following page are dissolved in
200	„	„	„	„ water, cooled, then stirred up with
150	„	„	„	„ albumen solution 1:1, to which
610	„	„	„	„ Standard Discharge (page 38) are added.
1000	parts	(approx.)		

Standard Reserve.

100 parts by weight of tartar emetic are dissolved in
400 „ „ „ „ water, then stirred with
375 „ „ „ „ British gum, boiled, and
125 „ „ „ „ ammonium chloride are added.

approx. 1000 parts.

The following dyestuffs are adapted for adding to the antimony reserve:

Diamine Fast Yellow A
Diamine Orange D
Oxy Diamine Orange R
Diamine Catechine G pat.
Diamine Catechine B pat.
Diamine Bordeaux B pat.
Diamine Red 10 B pat.
Diamine Scarlet B pat.
Diamine Scarlet 3 B pat.
Diamine Rose BD pat.
Diamine Rose BG pat.
Diamine Sky Blue pat.
Diamine Sky Blue FF pat.
Diamine Brilliant Blue G pat.

D. Various Print Styles produced with Basic Colours.

Padding with Basic Colours.

Cotton materials are frequently printed with Aniline Black and then topped or padded with basic colours.

The advantage of padding as compared with topping is its simplicity.

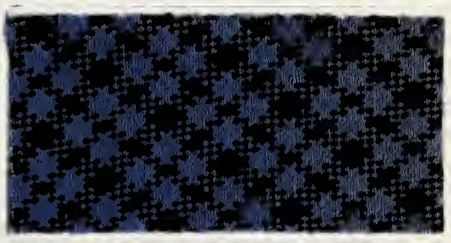
The following patterns have been padded in the padding machine, dried, steamed for about 20 minutes without pressure, and finished in the usual way for basic colours.

The padding colours are produced as follows:

No 1.

5 parts by weight of Tannin Heliotrope are dissolved with
2 „ „ „ „ tartaric acid solution 1:1,
1 „ „ „ „ chlorate of soda,
20 „ „ „ „ distilled water,
11 „ „ „ „ acetic acid of 8° Tw. and
8 „ „ „ „ acetine; then
150 „ „ „ „ tragacanth 65:1000 and
778 „ „ „ „ distilled water are added, and, when cold,
25 „ „ „ „ tannin-acetic acid 1:1.
1000 parts (approx.)

No 2.



5 parts by weight of New Methylene Blue N pat.;
otherwise same as No 1.

Basic Colours fixed with Albumen.

Basic colours may also be fixed with albumen.

On account of the simplicity of working, this method is particularly well suited for the production of cheap articles.

The annexed patterns have been printed as follows:

No 1.

5 parts by weight of New Methylene Blue N pat. are dissolved in
195 „ „ „ „ water, and when cold stirred with
200 „ „ „ „ albumen 1:1 and
600 „ „ „ „ starch tragacanth thickening T.
1000 parts (approx.)

No 2.

7 parts by weight of Tannin Heliotrope are dissolved in
193 „ „ „ „ water, and when cold stirred with
200 „ „ „ „ albumen 1:1 and
600 „ „ „ „ starch tragacanth thickening T.
1000 parts (approx.)

No 3.

10 parts by weight of Irisamine G pat. are dissolved in
190 „ „ „ „ water, and when cold stirred with
200 „ „ „ „ albumen 1:1 and
600 „ „ „ „ starch tragacanth thickening T.
1000 parts (approx.)

After printing, the goods are steamed for $^1/_4 - ^1/_2$ hour and sized on the back without being previously rinsed. If necessary however the goods will stand a light soaping quite well.

II.

Diamine Colours.

The application of the Diamine Colours in cotton printing is very extensive and varied. They come more especially into consideration for the following styles:

A. Dyeing with subsequent discharging.

B. Dyeing and padding of goods previously printed.

C. Direct printing.

A. Dyeing of Diamine Colours with subsequent Discharging.

The Diamine Colours are applied in various ways for this purpose, viz, they may be dyed direct, diazotised and developed, or coupled.

The dyeing and aftertreating of the Diamine Colours is fully described in our book on "Cotton Dyeing" and in our recently published Supplement No I, and we refer to the respective paragraphs in the said work:

1. Direct dyeing with Diamine Colours (dyeing and padding):

   "Cotton Dyeing", pages 313–320;
   Supplement No I, pages 121 and 136–153.

2. Diazotised and developed dyeings:

   "Cotton Dyeing", pages 320–327;
   Supplement No I, pages 147–153.

3. Coupled dyeings:

   "Cotton Dyeing", pages 328–329;
   Supplement No I, pages 141–153.

In special cases are also used:

4. Dyeings aftertreated with metallic salts:

   "Cotton Dyeing", page 320;
   Supplement No I, pages 137–153.

Dyeings subsequently treated with sulphate of copper and bichromate of potash are suitable only for coloured discharges.

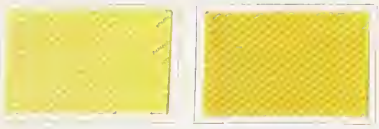
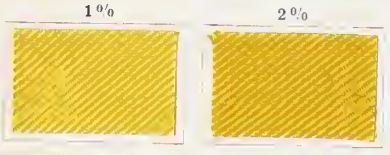
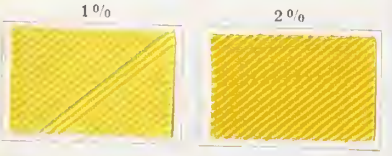
When discharged, dyeings aftertreated with sulphate of copper as a rule behave similarly to direct ones, except that the white obtained is somewhat duller.

Tabulation
of the Diamine Colours

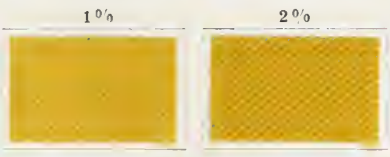
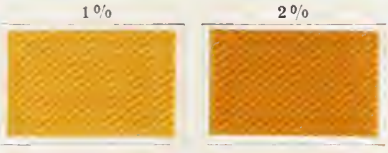
with particulars of the more important methods of application and their dischargeability.

Particulars regarding the properties of the various dyestuffs in respect to fastness to light, washing and hot pressing etc. are to be found in our book on "Cotton Dyeing", pages 12, 72, 92 and 114 and in Supplement No I, page 4.

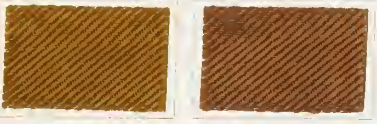
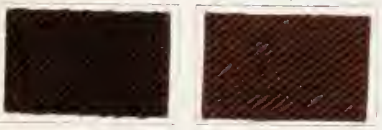
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Thioflavine S pat. 1% 2% 	Not dischargeable.	Not dischargeable.	Not dischargeable.	*Is used for lemon yellow shades and for those articles in which the yellow effect of the Thioflavine is required to stand out prominently.*
Oxy Diamine Yellow TZ 1% 2%	Not dischargeable.	Not dischargeable.	Not dischargeable.	*Does not withstand the various discharges quite so well as Thioflavine S.* *In certain cases it may be used as a cheap substitute for Thioflavine S.* *A further brand, viz. Oxy Diamine Yellow G G behares similarly to TZ.*
Diamine Fast Yellow B pat. 1% 2% 	Not dischargeable.	Not dischargeable.	Not dischargeable.	*These three dyestuffs belong to the same group and are distinguished for their excellent fastness to light and washing.* *Diamine Fast Yellow M and Diamine Fast Yellow FF are the brightest Yellows of this group and are used largely for padding and dyeing light shades of Yellow and Chamois; they are further used very extensively for printing bright yellow shades, for which purpose Diamine Fast Yellow FF, which is somewhat faster to washing, is to be given the preference.* *The products are very easily soluble and dye excellently level, and may therefore be used as yellows for mixtures For bright shades, Diamine Fast Yellow FF and M come into consideration, and Diamine Fast Yellow B for all other shades.*
Diamine Fast Yellow FF pat. 1% 2%				
Diamine Fast Yellow M pat. 1% 2% 				
Diamine Fast Yellow A 1% 2%	Not dischargeable.	Not dischargeable.	Not dischargeable.	*Diamine Fast Yellow A is applied in the same manner as Diamine Fast Yellow FF and is only somewhat more orange in shade. In fastness to light it is nearly as good as the Diamine Fast Yellows mentioned above, and in fastness to washing it is the best direct dyeing Yellow on the market. Another somewhat more reddish brand is Diamine Fast Yellow AR.*

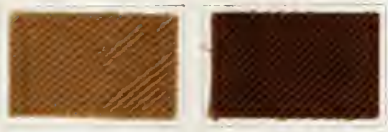
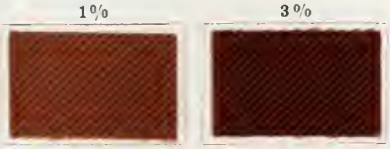
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Yellow CP 1 % 2 % 	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Very largely used as an easily dischargeable Yellow. It also renders good service in the padding of light shades.*
Diamine Gold pat. ½ % 1 % 	Easily dischargeable.	Easily dischargeable.	Dischargeable.	*Corresponds in properties pretty exactly with Diamine Yellow CP and is not affected by acids.*
Diamine Yellow N pat. 1 % 2 % 	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*In contrast to the other Diamine Colours, which are dyed with soda and salt, Diamine Yellow N is dyed with the addition of ½–1 % soap and 3–5 % phosphate of soda. It is the most easily dischargeable Yellow and is used both for discharging purposes and for printing yellow shades.*
Diamine Orange G 1 % 2 % 	May be used for coloured discharges.	May be used for coloured discharges.	May be used for coloured discharges.	*These two products are distinguished from the other direct dyeing Oranges by their comparatively good fastness to washing and light.*
Diamine Orange D 1 % 3 % 				*They are principally used for dyeing, padding and also for printing, for which they are specially well suited on account of their good solubility.*
Diamine Orange F 1 % 3 % 	Easily dischargeable on slightly prolonged steaming.	Dischargeable.	Dischargeable.	*Is the most easily dischargeable of the brighter direct dyeing Oranges; for white discharges, the steaming should be prolonged a little more than usual.*

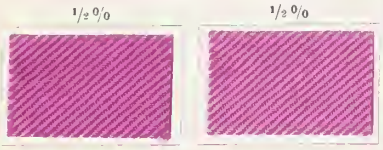
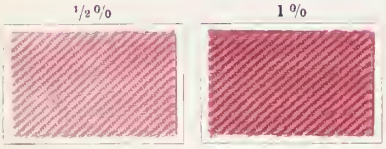
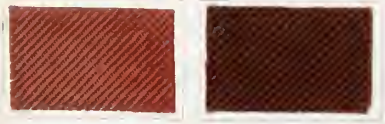
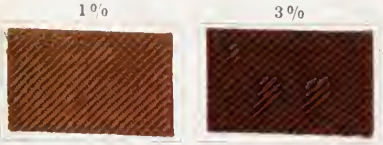
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Oxy Diamine Orange G and R 3% 3% 	Difficult to discharge.	Difficult to discharge.	Difficult to discharge.	*Dye bright Orange shades when dyed direct and are used particularly in the dyeing of plain goods for the production of manifold shades of yellowish-brown and mode shades.*
Cotton Brown A and N 4% 4% 	May be used for coloured discharges.	Not dischargeable.	May be used for coloured discharges.	*The large extent to which these products are used for piece-dyeing is due to their cheapness and their property of dyeing very full shades of Brown with good fastness to hot pressing.*
Oxy Diamine Brown 3GN and RN 3% 3% 	Easily dischargeable.	May be used for coloured discharges.	Easily dischargeable.	*For discharge styles these two Oxy Diamine Browns are to be preferred to the Cotton Browns, as they are very easily dischargeable, particularly so with Hyraldite.*
Diamine Brown R pat. and M pat. 3% 3% 	Easily dischargeable.	Dischargeable.	Easily dischargeable.	*The various brands of Diamine Brown as well as Diamine Catechine G and B are largely used for producing easily dischargeable medium and dark brown dyeings, particularly also on account of their good fastness to washing and light, which may be still further enhanced by an aftertreatment with sulphate of copper.* *The aftertreated dyeings may also be discharged white and in colours by means of Hyraldite.* *Diamine Catechine B levels excellently and is eminently adapted for the production of Greys and mode shades in combination with Diamine Fast Yellow B, Diamine Fast Blue FFB, Diamine Dark Blue B and Diaminogene extra, by means of dyeing or padding.*
Diamine Brown B pat. and S pat. 3% 3% 				
Diamine Catechine G pat. and B pat. 3% 3% 				

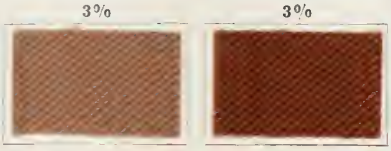
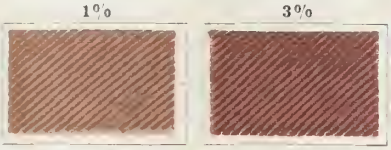
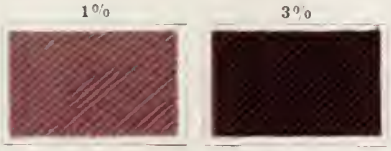
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Catechine 3 G 1% 3% 	Easily dischargeable.	Dischargeable.	Dischargeable.	*Behaves exactly like Diamine Catechine B and may be used in combination with the latter as well as the other Diamine Browns.*
Diamineral Brown G pat. 1% 3% 	May be used for coloured discharges.	May be used for coloured discharges.	May be used for coloured discharges.	*Is the best direct brown as regards fastness to light and may be used both for producing browns and for shading purposes. Another brand dyeing a more yellowish shade is Diamineral Brown 3 G pat.*
Diamine Brown No 30 pat. and No 32 pat. 3% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*These products are used especially for the dyeing of cheap articles; their dischargeability (especially of Diamine Brown No 30, 32, 34 and 38) is as good as that of the afore-mentioned Diamine Browns, whilst Nos 41 and 44 come into consideration for cheap reddish brown shades which are not to be discharged.*
Diamine Brown No 34 pat. and No 38 pat. 3% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	
Diamine Brown No 41 pat. and No 44 pat. 3% 3% 	Sufficiently well dischargeable only by lengthy steaming.	Not dischargeable.	Dischargeable.	
Diamine Bronze G pat. 1% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*This product is of special importance on account of its favourite shade for mode colours; it is also largely used for the dyeing of raised cotton goods.*

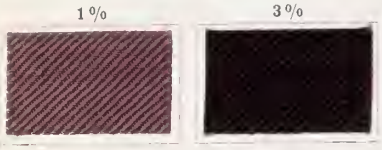
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Rose BD pat. and GD pat. ½ % ½ % 	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*The Diamine Rose brands are extensively used for the dyeing and padding of pink shades. In addition to these two brands, the following are known to the trade: Diamine Rose B extra, a concentrated form of BD, Diamine Rose BG which is a little yellower than BD, and Diamine Rose GGN which is somewhat yellower than GD.*
Direct Rose T ½ % 1 % 	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Behaves like Diamine Rose in its dischargeability; it is not quite so good as the latter in point of fastness to light, but superior in fastness to washing.*
Diamine Red 4B 1 % 3 %	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Is very largely used in piece-dyeing. The dyeings may be discharged comparatively easily, only care has to be taken that the rinsing and drying is carried out quickly enough, as the Red is apt to stain the white parts reddish. Diamine Red 5B and 6B are two products possessing properties similar to those of Diamine Red 4B, but are of a somewhat bluer shade.*
Diamine Red 10B pat. 1 % 3 %	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Behaves like Diamine Red 4B, but is much bluer in shade.*
Diamine Brilliant Scarlet S 1 % 3 % 	Dischargeable, but not quite so easily as Diamine Red 4B, and must be steamed a little longer.	Difficult to discharge.	Same as with Hyraldite.	*Diamine Brilliant Scarlet S is comparatively easy to discharge, and offers over Diamine Red 4B the advantage of much better fastness to acids; the pieces can thus after steaming be rinsed in water containing alum, which easily prevents bleeding into the discharged white.*
Diamine Fast Red F pat. 1 % 3 % 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*On account of its fastness to light, superior to that of all the other substantive Reds, it is given the preference, particularly so for deep shades of Red, Claret, Maroon etc. Diamine Red D and DN are similar in their behaviour; they are a little brighter and not quite so fast to light.*

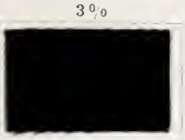
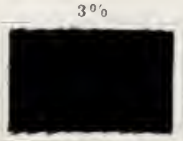
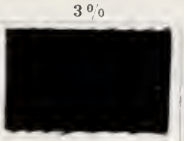
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Oxy Diamine Red S 1% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Behaves like Diamine Brilliant Scarlet S, being likewise not changed by acids.* *Serves for producing bluish scarlets.*
Diamine Scarlet 3B pat. 1% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Diamine Scarlet 3 B dyes bright, bluish red shades which are sufficiently resistant to organic acids.*
Diamine Purpurine B and 6B 3% 3% 	Easily dischargeable on prolonged steaming.	Easily dischargeable.	Easily dischargeable.	*In addition to Diamine Purpurine B and 6 B, the 3 B and V brands are known to the trade and in shade stand between the B and 6 B. These brands are not sensitive to organic acids.*
Diamine Violet Red pat. 1% 3% 	Easily dischargeable on prolonged steaming.	Easily dischargeable.	Easily dischargeable.	*Diamine Violet Red serves for producing bright bluish-red shades and otherwise behaves similarly to Diamine Red 4 B.*
Diamine Bordeaux B pat. 1% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Diamine Bordeaux B and S are very largely used for claret, corinth and ruby shades.* *Diamine Bordeaux B is very easily dischargeable, whilst Diamine Bordeaux S possesses the advantage of withstanding acids, so that goods dyed with the latter may be rinsed with the addition of alum.* *A third brand, viz. Diamine Bordeaux V R O, behaves like Diamine Bordeaux B, and yields very cheap dyeings.*
Diamine Bordeaux S pat. 1% 3%	Easily dischargeable on prolonged steaming.	Dischargeable.	Easily dischargeable.	

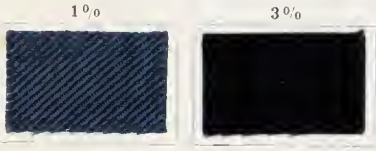
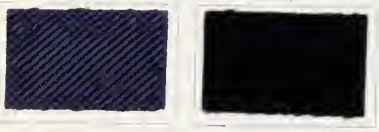
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Violet N pat. 1% 3% 	Easily dischargeable.	Easily dischargeable in pale shades, but more difficult in dark shades.	Easily dischargeable.	*Dyeings of very good fastness to light are obtained with Diamine Violet N, which is used to the widest extent both for dyeing and padding.* *Diamine Violet BB may be discharged in the same manner as Diamine Violet N.*
Oxy Diamine Violet B pat. and G pat. 3% 3%	Easily dischargeable.	Difficult to discharge.	Easily dischargeable.	*The Oxy Diamine Violet and Diamine Heliotrope brands are used largely for producing cheap purple, claret, corinth and prune shades.*
Diamine Heliotrope B and G pat. 3% 3%	Easily dischargeable on prolonged steaming.	Difficult to discharge.	Easily dischargeable.	*Further brands are: Oxy Diamine Violet R, which behaves similarly to Oxy Diamine Violet G, and Diamine Heliotrope O which resembles Diamine Heliotrope B.*
Diamine Blue 3R pat. and AZ pat. 3% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Diamine Blue 3R and AZ yield the most purplish shades amongst the bright Diamine Blues and are extensively used for reddish-blue shades with a coppery hue.* *By aftertreating with sulphate of copper shades are produced which are very fast to light and easily dischargeable.*
Diamine Blue BX pat. and BG pat. 3% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Serve for producing light, medium and navy blue shades and are distinguished for their easy dischargeability.*
Diamine Blue 2B pat. and 3B pat. 3% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	

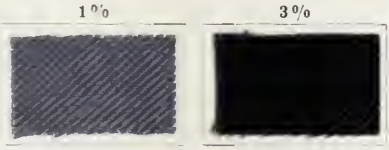
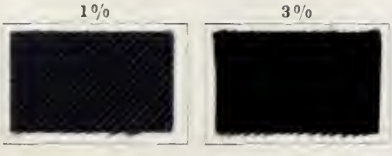
Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Sky Blue pat. 3% Diamine Pure Blue A pat. 3%	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Diamine Sky Blue FF, Diamine Sky Blue and Diamine Pure Blue A dye the brightest shades of light blue and are used to the widest extent both for padding and dyeing.*
Diamine Sky Blue FF pat. 3% Diamine Blue RW pat. 3%				*Diamine Blue RW yields fuller shades of the same brightness, Diamine Sky Blue FF and Diamine Blue RW may be aftertreated with copper sulphate and then yield shades which are very fast to light and can be readily discharged by means of Hyraldite.*
Diamine Brilliant Blue G pat. 1% 3%	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Possesses the same brightness as Diamine Blue RW and is somewhat more purplish and fuller than the latter. By aftertreatment with sulphate of copper the shade becomes somewhat redder and excellently fast to light; the fastness to washing is also enhanced, while the dischargeability remains very good.*
Diamine New Blue G pat. and R pat. 3% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Diamine New Blue G and R are somewhat inferior to the other Diamine Blues in point of brightness, but somewhat superior in fastness to washing and light. An aftertreatment with sulphate of copper gives similar results to those obtained with Diamine Brilliant Blue G.*
Diamine Azo Blue R pat. 1% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Is used for easily dischargeable medium and dark blue shades. A further brand, viz. Diamine Azo Blue RR is more difficult to discharge.*
Oxy Diamine Blue B and R 3%  3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*To the same group as the Oxy Diamine Blue B and R belong the G, 3G and 5G brands which are also easily dischargeable. The whole group is used mainly for the sake of its cheapness. The dyeings aftertreated with sulphate of copper may be well discharged with Hyraldite.*

Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Blue NC pat. 1% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Diamine Blue NC dyes a somewhat brighter Blue than Diamine Blue BX and is also superior to the latter in point of fastness to washing.*
Diamineral Blue R pat. and CV 3% 3%	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Both these products are very easily dischargeable; they are distinguished for very good fastness to washing and are used to the widest extent, both dyed direct and coppered, for the production of medium and dark Indigo shades. A third and somewhat brighter brand is Diamineral Blue 3B which behaves similarly to Diamineral Blue R.*
Diamine Steel Blue L pat. 1% 3% 	Easily dischargeable.	Easily dischargeable in light shades.	Easily dischargeable.	*Diamine Steel Blue L is used for greenish blue tones and for producing numerous compound shades.*
Diamine Fast Blue FFB pat. 1% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*The special value of the Diamine Fast Blues consists in the excellent fastness to light of their dyeings, which in this respect are superior to dyeings of Indigo.* *The products are used very largely both for dyeing blue shades and as shading products for olive, grey and all other mode shades, Diamine Fast Blue FFB being especially distinguished by its very good levelling property.*
Diamine Fast Blue FFG pat. 1% 3%				
Diamine Fast Blue G pat. 1% 3%				

Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Green B pat. and G pat. 3% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*All the Diamine Greens are easily dischargeable and are used very largely for producing green and olive shades.*
Diamine Green CL pat. 3% Diamine Dark Green N pat. 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Whereas in dyeing Diamine Green B, G, and Diamine Dark Green N, not more soda should be used than is absolutely necessary, Diamine Green CL may unhesitatingly be dyed either with or without soda.*
Diamine Grey G pat. 1% 3% 	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Serves for producing grey shades.*
Diamine Black BH pat. 1% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Both products belong to the most important saddening and shading products, as they level easily even under difficult circumstances.*
Diamine Dark Blue B pat. 1% 3%	Easily dischargeable.	Only dischargeable in light and medium shades.	Dischargeable.	*Diamine Dark Blue B offers over Diamine Black BH the advantage of being faster to light and hot pressing.*
Diamine Black HW pat. 1% 3% 	Easily dischargeable	Easily dischargeable.	Easily dischargeable.	*Diamine Black HW is used mainly for the production of greenish black and dark olive shades.*

Direct Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Jet Black Cr pat. and SS pat. 5% 5%	Easily dischargeable.	Dischargeable only in pale shades.	Dischargeable.	*The Diamine Jet Blacks are distinguished for their excellent fastness to light and are therefore used not only for black but also for grey shades of all descriptions, as well as for medium and dark blues.*
Diamine Jet Black RB pat. and OO pat. 5% 5%	Easily dischargeable.	Dischargeable only in pale shades.	Dischargeable.	
Oxy Diamine Black A pat. and SA pat. 5% 5%	Easily dischargeable.	Dischargeable only in pale shades.	Dischargeable.	*These products are used most extensively for cheap Blacks, the more so as they can be sufficiently well discharged in dark shades also.*
Oxy Diamine Black FFC pat. and RR pat. 5% 5%	Easily dischargeable.	Same as with Oxy Diamine Black A.	Dischargeable.	
Oxy Diamine Black JEI pat. and JW pat. 5% 5%	Easily dischargeable.	Same as with Oxy Diamine Black A.	Dischargeable.	*Oxy Diamine Black JEI and JW behave like the above named products and are only superior in fastness to light. Another brand is marketed under the denomination of Oxy Diamine Black JB which yields a somewhat bluer shade than the "JEI".*
Para Diamine Black B pat. 1% 5%	Easily dischargeable.	Same as with Oxy Diamine Black A.	Dischargeable.	*Behaves exactly like Oxy Diamine Black A and SA, only dyeing a somewhat brighter Black.*

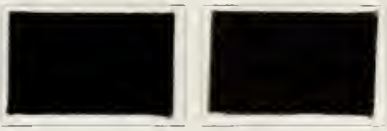
Diazotised and Developed Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diaminogene Blue BB pat. developed with Beta Naphtol 1½% 3%	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*With these two dyestuffs the most important Indigo shades are obtained, possessing excellent fastness to washing and being easy dischargeable.*
Diamine Azo Blue R pat. developed with Beta Naphtol 1½% 3%				
Diaminogene Sky Blue N developed with Beta Naphtol 1½% 3%	Very easily dischargeable.	Very easily dischargeable.	Very easily dischargeable.	*Especially for printing, this more recent group of Diaminogene Blues has attained a particular importance, chiefly because the white discharge effects do not appear yellowish but bluish white.* *The fastness to light and washing of the developed dyeings is very good.*
Diaminogene Blue NB pat. developed with Beta Naphtol 1½% 3%				
Diaminogene Blue NA pat. developed with Beta Naphtol 1½% 3%				
Diaminogene Blue 3RN pat. developed with Beta Naphtol 1½% 3%				

Diazotised and Developed Dyeings.

Name of the Colour	Dischargeability with Hyralidite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
4% Diamine Black BH pat. developed with Beta Naphtol / Phenylene Diamine	Easily dischargeable.	Dischargeable.	Easily dischargeable.	*Diamine Black BH developed with Beta Naphtol dyes dark blue shades, and by developing with Phenylene Diamine it yields the cheapest developed Blacks. The dyeings are easily dischargeable.*
4% Diaminogene B pat. developed with Beta Naphtol / Phenylene Diamine	Easily dischargeable.	Dischargeable.	Easily dischargeable.	*Diaminogene B behaves like Diamine Black BH, the shades obtained with Diaminogene B however being much faster to light and much finer and brighter. A further brand is Diaminogene extra which dyes greenish blue tones and, in combination with Diamogene B, is principally used for mercerised goods.*
4% Oxy Diaminogene OB pat. developed with Beta Naphtol / Phenylene Diamine	Very easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Oxy Diaminogene OB yields more blnish-black shades, Oxy Diaminogene OT on the other hand jet Blacks. The dyeings are all easily dischargeable.*
4% Oxy Diaminogene OT pat. developed with Phenylene Diamine / Resorcine	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	
4% Oxy Diaminogene ED pat. developed with Phenylene Diamine / Resorcine	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*Oxy Diaminogene ED and EF behave similarly to Oxy Diaminogene OB and OT, but dye a still finer Black with better fastness to light.*
4% Oxy Diaminogene EF pat. developed with Phenylene Diamine / Resorcine	Easily dischargeable.	Easily dischargeable.	Easily dischargeable.	*A further brand Oxy Diaminogene EM dyes a greenish Black and is used to a large extent, especially for mercerised goods.*

Coupled Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Cotton Brown A 3% and N 3%	Easily dischargeable.	Dischargeable.	Dischargeable.	*When coupled, the Cotton Browns yield very bright yellowish-brown shades which are very easily dischargeable, especially with Hyraldite.*
Diamine Nitrazol Brown BD 3% and B pat. 3% 	Easily dischargeable.	Dischargeable.	Dischargeable.	*The two Diamine Nitrazol Browns when coupled dye reddish-brown shades, Diamine Brown S on the other hand more purplish-brown shades. Such dyeings are distinguished for their very good fastness to washing and easy dischargeability.*
Diamine Brown S pat. 2% 3%	Easily dischargeable.	Dischargeable.	Dischargeable.	
Diamine Bronze G pat. 2% 3%	Easily dischargeable.	Dischargeable.	Easily dischargeable.	*Coupled with Nitrazol, Diamine Bronze G proves very valuable in practical dyeing, as it serves as a bottom for the various yellow brown shades.*
Diamine Blue NC pat. 2% 3%	Dischargeable.	Not dischargeable.	Dischargeable.	*Both colouring matters are principally used as shading products for coupled dyeings.*
Diamine Grey G pat. 2% 3%	Easily dischargeable.	Dischargeable.	Dischargeable.	

Coupled Dyeings.

Name of the Colour	Dischargeability with Hyraldite	Dischargeability with Tin Crystals	Dischargeability with Zinc Dust	Remarks
Diamine Nitrazol Black B pat. 3% 4%	Easily dischargeable.	Not dischargeable.	Dischargeable.	*Diamine Nitrazol Black B when coupled dyes a very covered jet black. It is principally used in combination with Paranitraniline Red, as together with the latter it dyes very good dark brown shades which are easily dischargeable.*
Oxy Diamine Black A pat. and SA pat. 3% 3%	Easily dischargeable.	Dischargeable.	Dischargeable.	*These colouring matters are all used for the same purposes as Diamine Nitrazol Black, Oxy Diamine Black A, Oxy Diamine Black JEI and Oxy Diamine Black JW dyeing jet black shades, and Oxy Diamine Black SA, Diamine Jet Black SS and Diamine Jet Black RB more blackish shades of brown.*
Oxy Diamine Black JEI pat. and JW pat. 3% 3%				
Diamine Jet Black SS pat. and RB pat. 3% 3%				

A great many of the Diamine Colours may also be discharged white with oxidation discharges, especially with the so-called chlorate discharge, fuller particulars regarding which will be found on page 74.

It is recommended to thoroughly rinse the goods to be discharged after dyeing, as the discharge effects will thus turn out a purer white.

Particular attention should also be paid to rinsing after discharging; for this purpose it is advisable to add some alum (5–8 oz per 10 gallons) to the first rinsing bath and to first rinse the discharged goods in this liquor.

Discharge Printing with Reducing Agents.

Diamine Colours are mostly discharged with reducing agents according to the following three methods:

1. Discharging with Hyraldite.
2. Discharging with tin crystals.
3. Discharging with zinc dust.

Of these, the discharging with Hyraldite is the latest, but already most extensively employed method, the tin crystals discharge, which was formerly used most, losing of late in importance.

The zinc dust discharge is chiefly used for heavy goods, such as plushes, blankets, velvets, etc., and especially also for producing discharge effects by hand block printing. There is however no doubt that the Hyraldite discharge offers considerable advantage as compared with the zinc dust discharges also by its more easy method of application, for which reason the Hyraldite discharges are given the preference.

The principal advantages of the Hyraldite discharge as compared with the tin crystals and zinc dust discharges are, that the fibre is not weakened even in lengthy steaming, that the print paste does not adhere to the engraved parts nor damage them, that the print colours keep well, and that a considerably better discharge effect is obtained.

1. Discharging with Hyraldite.

Two brands are known to the trade, viz., Hyraldite A and W, which are applied as follows:

White Discharge.

White Discharge with Hyraldite A.*)

2½–4 lbs of Hyraldite A are dissolved by heating with
3½–2 „ „ water and stirred up with
4 „ „ neutral starch tragacanth† thickening.

White Discharge with Hyraldite W.*)

2 –4 lbs of Hyraldite W are stirred to a paste with
8 –6 „ „ neutral starch tragacanth thickening,† which is then heated for about ¼ hour to 70° C. (160 deg. F.), stirred until cold, and then passed through a fine sieve.

† Neutral starch-tragacanth thickening.

10–12 lbs of wheat starch,
49–47 „ „ water,
40 „ „ tragacanth solution 65:1000 and
1 „ „ glycerine are boiled together for ½ hour and stirred until cold.
100 lbs or 10 gallons (approx.)

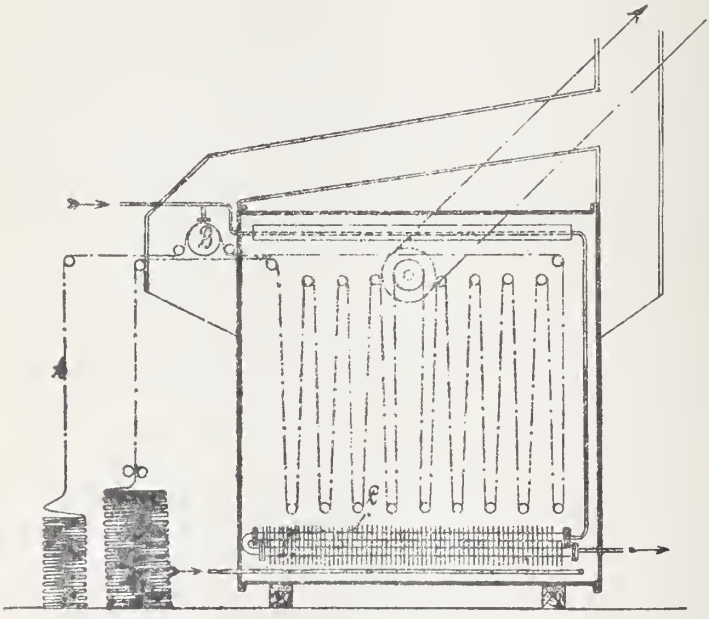
*) The white discharges also act as resists for Aniline Black; by the addition of a little acetate of soda the effect of the discharges on Aniline Black may be still further enhanced.

Starch tragacanth thickening has proved the most suitable thickening agent, but, if necessary, ordinary gum or British gum may also be employed.

The quantity of Hyraldite to be used depends in the first place on the depth of the shades and that of the engravings. The strong standard discharges may be diluted according to requirement by the addition of thickening.

After printing, the goods are dried well and steamed for a few minutes (in one passage) in a Mather & Platt.

In order to ensure the best results, the steam should be as hot and dry as possible. The temperature in the steam box should be about 102—105° C. (215—220 deg. F.), which may be attained by reducing to the smallest possible size the openings by which the goods pass in and out. More powerful heating arrangements than ordinarily employed may also be provided inside the Mather & Platt, as shown in the accompanying sketch.



The goods to be discharged (A) pass over the drying drum (B) into the Mather & Platt. (C) represents the gilled pipes, the number of which depends on the size of the steamer.

The other arrangements are the same as in the ordinary Mather & Platt.

After steaming, the goods are washed.

Coloured Discharges.*)

a) Coloured Discharges with Basic Colours.

For coloured discharges with basic colours, the tannin requisite for fixing is either added to the discharge colour direct, or the fabric is submitted to a special process with tannin.

The following basic colours are the best adapted for coloured discharges in combination with Hyraldite:

New Methylene Blue NSS, GG
Irisamine G
Rosazeïne 6G
Thioflavine T
Paraphosphine R, G, GG.

Coloured Discharges with the addition of tannin to the print colour.

Blue Discharge:

30 parts by weight of New Methylene Blue NSS are boiled for 1/2 hour with
10 „ „ „ „ wheat starch,
310 „ „ „ „ gum solution 1:1, and
50 „ „ „ „ glycerine and stirred until cold;
then the cold solution of
50 „ „ „ „ tannin in
50 „ „ „ „ glycerine is added, and, whilst stirring well,
200–250 „ „ „ „ Hyraldite A dissolved warm in
300–250 „ „ „ „ water are added, and the discharge colour is then cooled off.
1000 parts (approx.)

Pink Discharge:

30–50 parts by weight of Rosazeïne 6G,
10 „ „ „ „ wheat starch and
310–290 „ „ „ „ gum solution 1:1 and
50 „ „ „ „ glycerine are boiled together for 1/2 hour and stirred until cold; then the cold solution of
50 „ „ „ „ tannin and
50 „ „ „ „ glycerine is added, and, whilst stirring well,
200–250 „ „ „ „ Hyraldite A dissolved in
300–250 „ „ „ „ warm water are added, and the discharge colour is then cooled off.
1000 parts (approx.)

Yellow Discharge:

30–50 parts by weight of Thioflavine T;
otherwise same as for Pink.

*) The coloured discharges may be employed, in the same manner as the white discharges as resists for Aniline Black.

Green Discharge:

500 parts by weight of Blue Discharge (as on page 63)
1000 „ „ „ „ Yellow Discharge (as on page 63).

The pieces printed with coloured discharges are steamed as aforestated, and afterwards given either a short air passage or plaited down several times in order to better develop the shade.

The pieces are then taken full-width at about 40° C. (105 deg. F.) through a bath containing about 8 oz tartar emetic or antimony salt per 10 gallons, then rinsed, and if necessary soaped.

For coloured discharges, gum or British gum have proved the most adaptable as thickening agents; starch or starch tragacanth thickening only come into consideration in certain cases for deep shades.

In dissolving the dyestuffs, 4–5 parts by weight of methylated spirits are to advantage used per 100 parts of print colour.

In order to ensure better levelling of the discharges prepared with basic colours, 5 parts Phenol per 100 parts print colour may be added.

It should be observed that not too great an excess of Hyraldite be used for the coloured discharges, and that the steam be not too dry, as some of the colours will otherwise be reduced too much in the Mather & Platt and are then more difficult to bring up again to the right tone. Should this have been the case, the pieces are allowed to pass over open steam, whereby they absorb moisture; in the subsequent air passage the reduced colours will then more easily develop.

Coloured Discharges on Fabrics previously treated with tannin.

The material dyed with Diamine Colours is dried and prepared with tannin, some chlorate of soda being added to advantage.

Tannin Padding Solution.

8 oz–2 lbs tannin and
3–4½ oz chlorate of soda
are dissolved in
10 gallons water.

The goods are padded with this solution, dried on drying drums, and then printed with the discharge colour.

Blue Discharge.

30 parts by weight of New Methylene Blue NSS,
10 „ „ „ „ wheat starch,
310 „ „ „ „ gum solution 1:1 and
50 „ „ „ „ glycerine are boiled together for ½ hour, and stirred until cold; then the solutions of
200–250 „ „ „ „ Hyraldite A in
300–250 „ „ „ „ water (warm) and
25 „ „ „ „ tartar emetic (sodium salt) in
75 „ „ „ „ water are added.

1000 parts (approx.)

Pink Discharge.

30 – 50 parts by weight of Rosazeine 6G,
10 „ „ „ „ wheat starch,
310 – 290 „ „ „ „ gum thickening 1:1 and
50 „ „ „ „ glycerine are boiled together for 1/2 hour and stirred until cold; then the solutions of
200 – 250 „ „ „ „ Hyraldite A in
300 – 250 „ „ „ „ water (warm) and
25 „ „ „ „ tartar emetic (sodium salt) in
75 „ „ „ „ water are added.

1000 parts (approx.)

Yellow Discharge.

30 – 50 parts by weight of Thioflavine T;
otherwise same as for Pink.

Green Discharge.

500 parts by weight of Blue Discharge (as above).
1000 „ „ „ „ Yellow Discharge (as above).

In the case of light shades such as Pink and Cream, the addition of tartar emetic to the discharge colour is omitted.

Pieces printed with coloured discharges are also steamed as stated above and then given a short air passage or folded down several times.

In certain cases the tanning may also be postponed until after the steaming, and if this is the case the addition of chlorate of soda to the tannin solution is omitted.

The steamed and in some cases subsequently tanned pieces are taken full width through a cold bath containing 5 – 8 oz bichromate of potash per 10 gallons, then rinsed, and dried.

Another method of aftertreatment is the following: The pieces after being steamed and folded down are run through a full-width washing machine, the first small box of which contains a solution of

4 lbs sulphate of alumina in
10 gallons water

at a temperature of 80 – 100° C. (175 – 212 deg. F.); they are then steamed for 10 – 15 seconds in a second box, rinsed at 50 – 60° C. (120 – 140 deg. F.) in the third and fourth boxes (without however soaping), and finally dried.

b) Coloured Discharges with Diamine Colours.

For yellow discharges the Diamine Colours may also be applied to advantage, the following being especially suitable for the purpose:

Thioflavine S
Diamine Fast Yellow B and FF
Oxy Diamine Yellow TZ and GG
Primuline.

The discharges are prepared as follows:

30	parts	by	weight	of	dyestuff,
220	„	„	„	„	water,
100	„	„	„	„	glycerine,
30	„	„	„	„	phosphate of soda and
250	„	„	„	„	British gum are boiled together and when cold mixed with
200–250	„	„	„	„	Hyraldite A dissolved in
170–120	„	„	„	„	water.
1000	parts	(approx.)			

c) Coloured Discharges with Mordant Colours.

For blue effects, the various colours of the Gallocyanine group may be printed on together with Hyraldite.

Discharge colours of this kind are prepared as follows:

50	parts	by	weight	of	Modern Violet 40 % are stirred to a paste with
50	„	„	„	„	water, then stirred with
450	„	„	„	„	British gum 1:1, and mixed with
250	„	„	„	„	Hyraldite A dissolved in
150	„	„	„	„	water and with
50	„	„	„	„	Chrome solution C.*
1000	parts	(approx.)			

20	parts	by	weight	of	Coreïne RR are stirred to a paste with
90	„	„	„	„	water, then stirred with
450	„	„	„	„	British gum 1:1, and mixed with
200–250	„	„	„	„	Hyraldite A dissolved in
220–170	„	„	„	„	water and with
20	„	„	„	„	Chrome Solution C.*
1000	parts	(approx.)			

100	parts	by	weight	of	Phenocyanine paste are stirred into
460	„	„	„	„	British gum 1:1, to which are then added
200–250	„	„	„	„	Hyraldite A dissolved in
220–170	„	„	„	„	water and
20	„	„	„	„	Chrome solution C.*
1000	parts	(approx.)			

* Chrome Solution C.

125	parts	by	weight	of	chrome-alum are dissolved with
615	„	„	„	„	water to which
250	„	„	„	„	caustic soda lye of 77° Tw. and
10	„	„	„	„	glycerine are added.
1000	parts	(approx.)			

The printed pieces are steamed as stated above and then taken through a bath of about 40° C. (about 105 deg. F.) containing 8 oz bichromate of potash or soda per 10 gallons. The goods are finally rinsed and if necessary soaped.

d) Coloured Discharges with the addition of Albumen.

Bright coloured discharges may also be obtained with albumen as a fixing agent, in which case

1. basic colours,
2. earth or pigment colours

may be applied.

The discharge colours are prepared as follows:

1. With basic colours:

30	parts by weight of Thioflavine T are dissolved in
190	„ „ „ „ water and
50	„ „ „ „ glycerine, cooled off, and mixed with
200–250	„ „ „ „ Hyraldite A dissolved in
200–150	„ „ „ „ water and
210	„ „ „ „ tragacanth thickening 65:1000. When quite cold,
120	„ „ „ „ albumen solution 1:1 are added.
1000	parts (approx.)

In the same manner New Methylene Blue NSS may be used for blue, a mixture of blue and yellow for green, and Rosazeine 6G for pink.

2. With earth or pigment colours:

150	parts by weight of Ultramarine (dark) are reduced to a paste with
50	„ „ „ „ water and
50	„ „ „ „ glycerine and stirred together with
200–250	„ „ „ „ Hyraldite A dissolved in
200–150	„ „ „ „ water and
230	„ „ „ „ tragacanth thickening 65:1000. When completely cold,
120	„ „ „ „ albumen solution 1:1 are added.
1000	parts (approx).

The colours fixed with albumen are then steamed as shown above, and if accompanying white effects have been printed at the same time, the goods are rinsed full-width, and dried.

Both Hyraldite A and W are suited for white discharges, whilst for coloured discharges Hyraldite A is always to be given the preference. For deep shades and goods which are not so easily dischargeable (such as raised cotton goods), Hyraldite W is used for white discharges, as its discharging power is somewhat greater than that of the "A" brand.

The patterns on the following three tables III, IV and V are (as thereon indicated) partly discharged white with Hyraldite A and partly also with Hyraldite W, while the coloured discharges have been prepared with Hyraldite A and basic colours, with the addition of tannin to the discharge colour, as described on page 63.

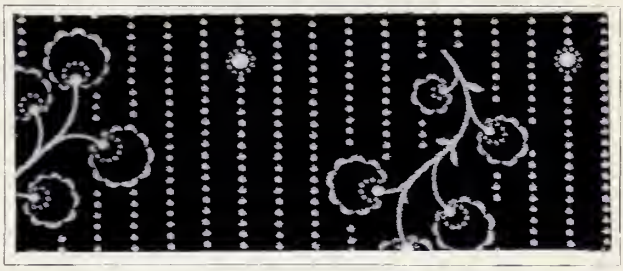
Diamine Colours, discharged with Hyraldite pat.

Dyed with
Diaminogene Sky Blue N
developed with
Beta Naphtol.

White discharge:
Hyraldite W.

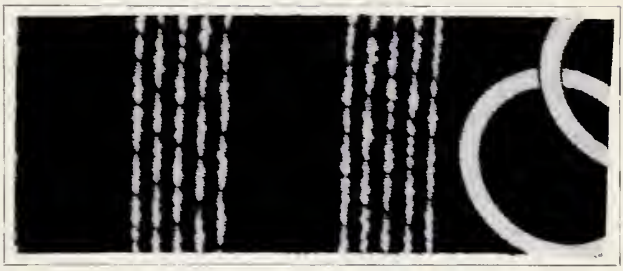
Dyed with
Diaminogene Blue NB
developed with
Beta Naphtol.

White discharge:
Hyraldite W.



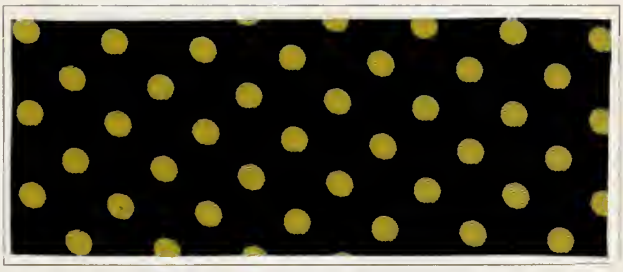
Dyed with
Diaminogene Blue NA
developed with
Beta Naphtol.

White discharge:
Hyraldite W.



Dyed with
Diaminogene Blue 3RN
developed with
Beta Naphtol.

Yellow discharge:
Thioflavine T.
(Instructions: page 63.)



Dyed with
Diaminogene Blue NA
developed with
Beta Naphtol.

Green discharge:
New Methylene Blue NSS
Thioflavine T.
(Instructions: page 63.)

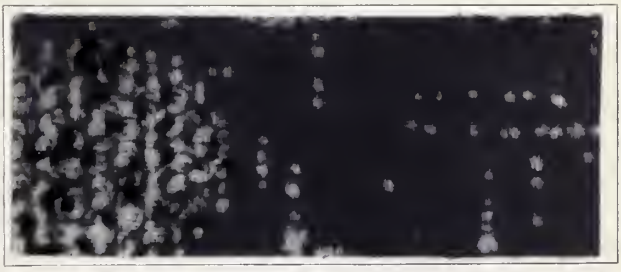
Diamine Colours, discharged with Hyraldite pat.

Dyed with
Diamine Catechine B
Diamine Dark Blue B
Diamine Yellow CP.
Discharged with
Hyraldite A.

Dyed with
Diamine Brown M
Diamine Dark Blue B
Diamine Red 4B.
Discharged with
Hyraldite A.

Dyed with
Diamine Fast Blue FFB
Diamine Catechine B
Diamine Yellow CP.
Discharged with
Hyraldite A.

Oxy Diamine Black JW
Oxy Diamine Brown RN.
Discharged with
Hyraldite A.



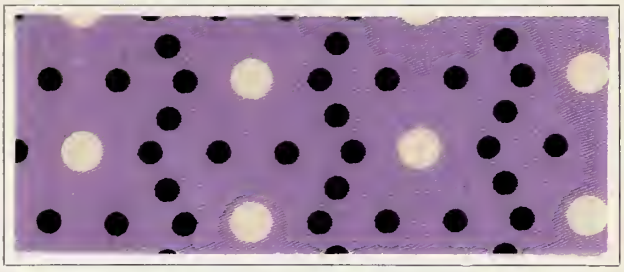
Diamine Nitrazol Brown BD
Diamine Yellow CP.
Coupled with
Nitrazol C.
Discharged with
Hyraldite A.

Diamine Colours, discharged with Hyraldite pat.

Dyed with
Diamine Rose BD
Diamine Brilliant Blue G.

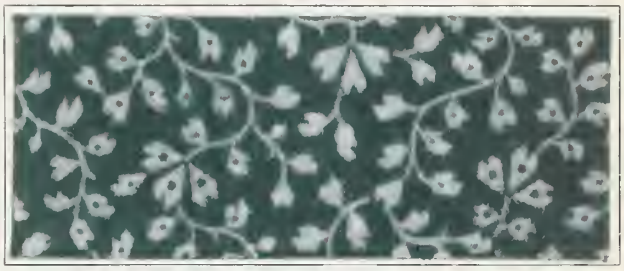
White discharge:
Hyraldite W.

Black Print:
Aniline Black.



Dyed with
Diamine Green B.

White discharge:
Hyraldite W.

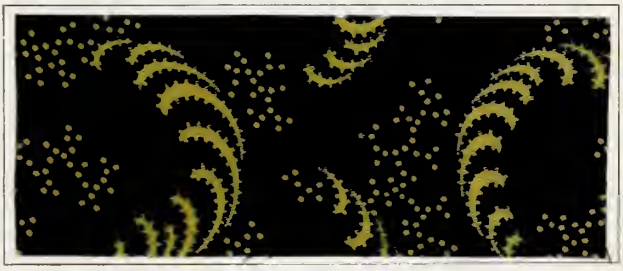


Dyed with
Oxy Diaminogene EF
developed with
Phenylene Diamine.

Blue discharge:
New Methylene Blue NSS.
(Instructions: page 63.)

Dyed with
Oxy Diaminogene EF
developed with
Phenylene Diamine.

Yellow discharge:
Thioflavine T.
(Instructions: page 63.)



Dyed with
Oxy Diaminogene OB
developed with
Phenylene Diamine.

White discharge:
Hyraldite W.

2. Tin Discharges.

The tin discharges in which tin crystals (stannous chloride) or other stannous oxide salts (acetate of tin, stannous ferrocyanide, stannous sulphocyanide) form the effective substance, are of varied composition according to the duration of the steaming.

The tin discharges applied most frequently are the following:

A. Discharges for short steaming.

(For articles which after printing are developed in the small Mather & Platt.)

I. Standard Tin Crystals Discharge.

354	parts	by	weight	of	British gum are stirred to a paste with
141	„	„	„	„	water, and
300	„	„	„	„	acetate of tin of 28° Tw. and
15	„	„	„	„	tartaric acid are added, boiled together, and before cooling off
150	„	„	„	„	tin crystals, and when cold,
40	„	„	„	„	acetate of soda are added.
1000	parts	(approx.)			

II. Discharge with Tin Crystals and Acetate of Soda.

This discharge acts similarly to No I. Owing to the absence of acetate of tin, its preparation is more simple.

360	parts	by	weight	of	British gum are stirred to a paste with
382	„	„	„	„	water, and
18	„	„	„	„	tartaric acid are added; these are boiled together, and before cooling off,
200	„	„	„	„	tin crystals, and before use,
40	„	„	„	„	acetate of soda are added.
1000	parts	(approx.)			

In order to give the white a slightly bluish tinge, 10 parts of Alkaline Blue in solution (2:100) are added to Discharges I and II.

III. Stannous Ferrocyanide Discharge.

This discharge is a little more expensive than I and II, but the white obtained therewith is clearer and more bluish.

50 parts by weight of wheat starch,
215 „ „ „ „ water,
100 „ „ „ „ white dextrine and
30 „ „ „ „ tartaric acid (powder) are boiled together; to the warm mixture
220 „ „ „ „ tin crystals are added, and when cold the whole is stirred up with
110 „ „ „ „ ferrocyanide of potash,
75 „ „ „ „ water and
200 „ „ „ „ gum mucilage 1:1
} dissolved and stirred until cold.

1000 parts (approx.)

IV. Stannous Sulphocyanide Discharge.

This discharge in its action is similar to I and II. The White is not so good as that obtained by using the stannous ferrocyanide discharge.

60 parts by weight of wheat starch,
60 „ „ „ „ British gum and
370 „ „ „ „ water are boiled together, and
100 „ „ „ „ acetine,
250 „ „ „ „ tin crystals,
50 „ „ „ „ citrate of ammonia of 36° Tw.,
60 „ „ „ „ acetate of soda and
50 „ „ „ „ sulphocyanide of barium are added.

1000 parts (approx.)

V. Alkaline Tin Discharge.

This discharge is only used when mineral colours are added to the discharge.

60 parts by weight of weat starch,
60 „ „ „ „ water,
160 „ „ „ „ dextrine (white) and
360 „ „ „ „ hydrate of stannous oxide paste are boiled together; when cold,
110 „ „ „ „ ammonium chloride are added as well as
130 „ „ „ „ tartrate of ammonia mixed with
120 „ „ „ „ tragacanth solution 65:1000.

1000 parts (approx.)

B. Discharges for prolonged steaming.

The following discharges serve for styles requiring prolonged steaming (about $^1/_2 - ^3/_4$ hour).

VI. Acetate of Tin Discharge.

125	parts	by	weight	of	wheat starch,
835	„	„	„	„	acetate of tin of 28° Tw.,
30	„	„	„	„	acetic acid of 8° Tw. and
5 – 10	„	„	„	„	tartaric acid (powder) are boiled together.
1000	parts	(approx).			

VII. Tin Crystals and Acetate of Soda Discharge.

This discharge is in its effect very similar to the foregoing discharge No VI.

80	parts	by	weight	of	wheat starch,
40	„	„	„	„	white dextrine,
270	„	„	„	„	acetic acid of 8° Tw. and
5 – 10	„	„	„	„	tartaric acid (powder) are boiled together;
270	„	„	„	„	tin crystals are added before cooling off and
330	„	„	„	„	acetate of soda after cooling.
1000	parts	(approx.)			

Coloured Discharges.

VIII. For short steaming.

30 – 60	parts	by	weight	of	dyestuff are dissolved in
100	„	„	„	„	acetic acid of 8° Tw.; then
200	„	„	„	„	gum thickening 1:1 are added, and when cold,
120	„	„	„	„	tannin dissolved in
120	„	„	„	„	acetic acid are added cold, and
400	„	„	„	„	tin crystals discharge I or II are stirred in.
1000	parts	(approx.)			

IX. For prolonged steaming.

30 – 60	parts	by	weight	of	dyestuff are dissolved in
100	„	„	„	„	acetic acid of 8° Tw.; then
200	„	„	„	„	gum thickening 1:1 are added, and when cold,
120	„	„	„	„	tannin dissolved cold in
120	„	„	„	„	acetic acid are added, and the whole is stirred up with
400	„	„	„	„	acetate of tin (see above).
1000	parts	(approx.)			

The following dyestuffs are adapted for coloured discharges:

For Yellow: Thioflavine T and S, Phosphine IIa, Paraphosphine G and R, Diamine Fast Yellow B and FF, Oxy Diamine Yellow TZ, GG, Primuline;
„ Pink: Irisamine G, Rosazeine 6G;
„ Red: Safranine or Irisamine with Thioflavine T;
„ Blue: New Methylene Blue shaded if required with Methyl Violet BB 72 No 0;
„ Green: Brilliant Green or Solid Green with Thioflavine T;
„ Violet: Tannin Heliotrope, Methyl Violet BB 72 No 0, Crystal Violet 5B;
„ Brown: Aniline Yellow.

The dyeings with coloured discharges are given a cold tartar emetic or antimony salt passage subsequent to the steaming or passing through the Mather & Platt. In the case of dyeings discharged with New Methylene Blue this passage is to advantage substituted by one through a cold chrome bath (1½ oz bichromate of potash per 10 gallons).

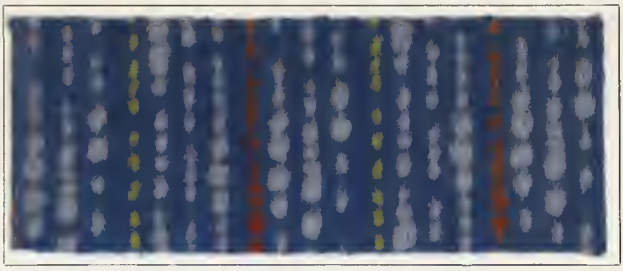
According to the depth of the engravings, the discharges may either be reduced or increased in strength by the addition of tin crystals. Especially in the case of light shades the discharges should be considerably stronger.

All the discharges may also act as resists for Aniline Black.

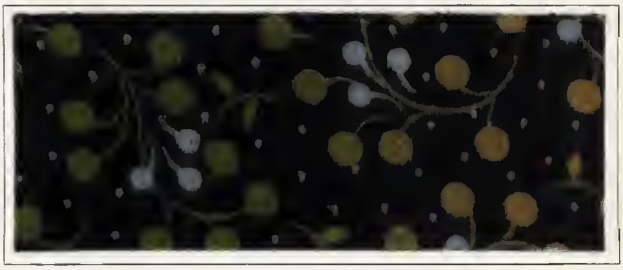
Diamine Colours, discharged with Tin Crystals.

(As per details on pp. 69—72.)

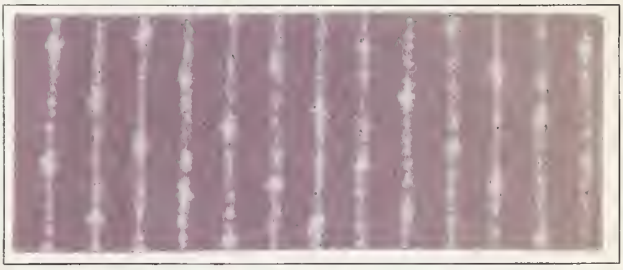
Dyed with
Diamine Sky Blue FF.
White discharge:
Tin crystals discharge II.
Red discharge:
Rosazeine 6G.
Yellow discharge:
Thioflavine T.



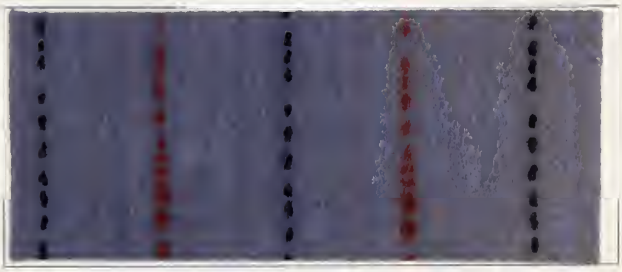
Dyed with
Diamine Fast Blue FFB
Diamine Yellow CP.
White discharge:
Tin crystals discharge II.
Green discharge:
New Methylene Blue NSS
Thioflavine T.



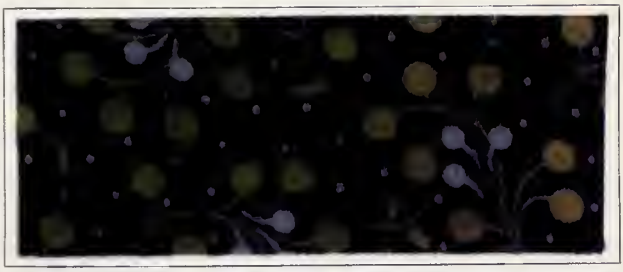
Dyed with
Diamine Violet N.
White discharge:
Stannous ferrocyanide discharge.



Dyed with
Diamine Dark Blue B
Diamine Rose BD.
White discharge:
Tin crystals discharge I.
Red discharge:
Rosazeine 6G.
Blue discharge:
New Methylene Blue NSS.



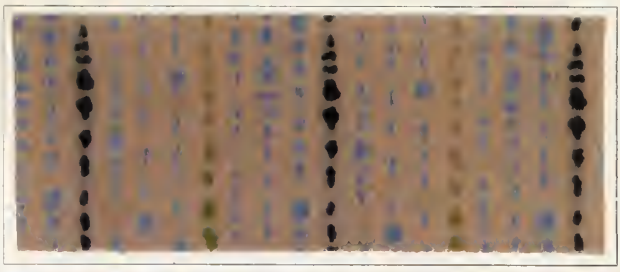
Dyed with
Diamine Brilliant Blue G
Diamine Rose GD.
White discharge:
Tin crystals discharge II.
Green discharge:
New Methylene Blue NSS
Thioflavine T.



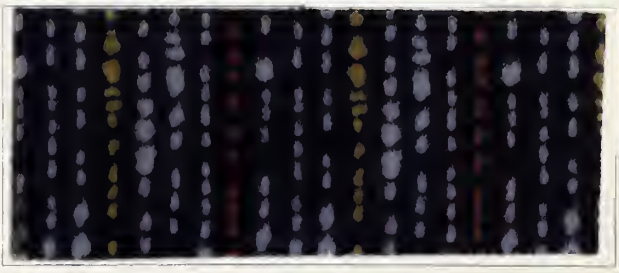
Diamine Colours, discharged with Tin Crystals.

(As per details on pp. 69 – 72.)

Dyed with
Diamine Red 10B.
White discharge:
Stannous ferrocyanide discharge.
Green discharge:
New Methylene Blue NSS
Thioflavine T.
Blue discharge:
New Methylene Blue NSS.

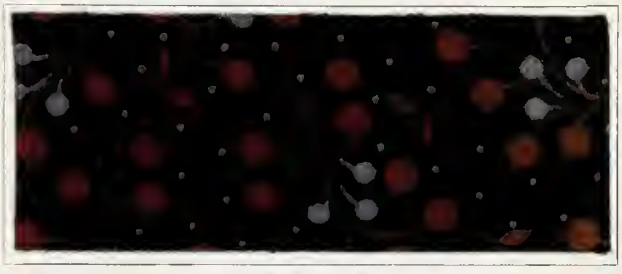


Dyed with
Diamine Fast Blue FFB.
White discharge:
Stannous ferrocyanide discharge.
Yellow discharge:
Paraphosphine G.
Red discharge:
Rosazeine 6G.



Dyed with
Diamine Catechine G
Diamine Catechine B.
Green discharge:
New Methylene Blue NSS
Thioflavine T.
Blue discharge:
New Methylene Blue NSS.

Dyed with
Diamine Dark Green N
Diamine Yellow CP.
White discharge:
Sulphocyanide of tin discharge.
Red discharge:
Rosazeine 6G.



Dyed with
Oxy Diaminogene OT
developed with
Phenylene Diamine.
White discharge:
Stannous ferrocyanide discharge.

3. Zinc Dust Discharge.

330 parts by weight of zinc dust,
420 „ „ „ „ gum thickening 1:1 and
50 „ „ „ „ glycerine are mixed together and ground well, and before use mixed with
60 „ „ „ „ ammonia and
140 „ „ „ „ bisulphite of 70° Tw.

1000 parts (approx.)

If this discharge is to serve for roller printing, first quality zinc dust must be used and the print colour be ground well in a ball mill or some other wet-grinding mill before adding the bisulphite.

The discharge should be printed on with the brush to prevent the zinc dust from blocking the engraved parts.

After printing, the goods are steamed for $^1/_2$—$^3/_4$ hour, then soured in water slightly acidulated with hydrochloric acid, and rinsed well.

In the case of dyestuffs which are sensitive to acids, a trace of soda may be added to the rinsing bath.

For coloured discharges the following dyestuffs may be added to the zinc dust discharge:

Safranine
Phosphine
Methylene Blue BB
New Methylene Blue N
Oxy Diamine Yellow TZ, GG
Thioflavine T and S
Primuline.

In the case of all dyestuffs the action of the zinc dust discharge is more efficacious than that of the tin crystals discharge, so that a good white may as a rule be obtained with the former even in the case of dyestuffs which are difficult to discharge.

Discharge Printing with Oxidising Agents.

A great part of the Diamine Colours may also be discharged white with oxidising agents, and more especially by means of the ordinary chlorate discharges. The discharge effects as a rule are very good.

Pale shades naturally give a better white than dark ones, and in a like manner direct dyeings are as a rule more easily dischargeable than those aftertreated with metallic salts.

The following chlorate discharges may be used:

I. 350 parts by weight of British gum (powder),
350 „ „ „ „ water,
180 „ „ „ „ chlorate of soda and
20 „ „ „ „ ferricyanide of potassium are stirred together to a paste, boiled, and when cold,
100 „ „ „ „ citrate of ammonia of 36° Tw. are added.
1000 parts (approx.)

The following discharge is more efficacious:

II. 175 parts by weight of chlorate of soda are dissolved in
240 „ „ „ „ water, mixed with
70 „ „ „ „ China clay, rubbed down in
70 „ „ „ „ water and boiled with
250 „ „ „ „ British gum; while cooling off,
125 „ „ „ „ finely powdered tartaric acid are added at about 70° C. (160 deg. F.) and, when cold,
70 „ „ „ „ ferricyanide of ammonia solution of 41° Tw. (page 35).
1000 parts (approx.)

The goods should be steamed in the Mather & Platt for 1 to 5 minutes according to the strength and quantity of the discharge which has been printed on, then rinsed, and dried.

The following Diamine Colours are suited for discharging by means of the chlorate discharge:

Diamine Yellow N pat.
* *Diamine Orange B*
* *Oxy Diamine Orange G*
* *Diamine Rose pat., all brands*
Diamine Red 4B, 5B, 6B, 10B, D pat.
Diamine Brilliant Scarlet S
Diamine Fast Red F pat.
Diamine Violet Red pat.
Diamine Brown pat. M, S, 3G
* *Diamine Brown B pat.*
Diamine Brown R pat.
Diamineral Brown G pat.
Diamine Catechine pat. B and G
* *Diamine Bronze G pat.*
Diamine Nitrazol Brown BD, RD
Diamine Heliotrope pat. G, 0 and B
Diamine Blue pat. 3R, BX, 2B, 3B, RW, C4B, BG, NC
Diamine Azo Blue R pat.
Diamine Brilliant Blue G pat.
Oxy Diamine Blue G, R
Diamine Sky Blue pat.

Diamine Sky Blue pat. A und FF
Diamineral Blue R pat.
* *Diamine Fast Blue G pat.*
Diamine New Blue R pat.
Diamine Steel Blue L pat.
Diamine Dark Blue B pat.
Diaminogene extra pat. (dyed direct)
* *Diamine Green pat. B, G, CL*
* *Diamine Dark Green N pat.*
Diamine Black pat. BH, HW, R0, B0
Diamine Blue Black pat. E und R
Diamine Grey G pat.
Diamine Jet Black pat. SS, Cr, RB, 00
Oxy Diamine Blackpat. S000, B, M, N
Oxy Diamine Black pat. JW, JWF, JB, JEI
Oxy Diamine Black pat. A, AM, SA
Para Diamine Black B pat.
Diamine Brown M pat.
diazotised and developed with Beta Naphtol
Diamine Brown M pat.
diazotised and developed with Phenylene Diamine
Diamine Brown S pat.
diazotised and developed with Phenylene Diamine
Diaminogene Blue G pat.
diazotised and developed with Beta Naphtol
Diaminogene Blue BB pat.
diazotised and developed with Beta Naphtol
* *Diaminogene Sky Blue N*
diazotised and developed with Beta Naphtol
Diaminogene Dark Blue pat.
diazotised and developed with Beta Naphtol
Diamine Azo Blue R pat.
diazotised and developed with Beta Naphtol
Diamine Azo Blue 6B pat.
diazotised and developed with Beta Naphtol
Diamine Black BH pat.
diazotised and developed with Beta Naphtol
Diamine Black BH pat.
diazotised and developed with Phenylene Diamine
Diaminogene pat. extra and B
diazotised and developed with Beta Naphtol
Diaminogene pat. extra and B
diazotised and developed with Phenylene Diamine
Diamine Nitrazol Black B pat.
coupled with Nitrazol C pat.
* *Diamine Nitrazol Brown BD, RD*
coupled with Nitrazol C pat.
Oxy Diamine Black pat. A, SA, JW, JEI
coupled with Nitrazol C pat.

The dyestuffs marked with an asterisk (*) are the most easily dischargeable and the best suited for white discharges.

The following Diamine Colours resist the oxidising action of the chlorate discharges and may therefore be added to the same for coloured discharging of Diamine Colours, Alizarine Colours, Indigo etc.:

Diamine Yellow CP
Diamine Fast Yellow A, AR, FF
Diamine Fast Yellow B.

(For the production of coloured chlorate discharges, earth and pigment colours as well as Rosazeine 6G are further adapted, which are then fixed with albumen.)

Diamine Colours in combination with Paranitraniline Red for the production of white and red effects on a brown bottom.

By first dyeing with Diamine Colours and then topping with Paranitraniline Red, very fast brown shades are obtained which may be discharged white and in colours by means of Hyraldite.

According to our new patented process, special red effects may be obtained on materials dyed in this manner, in addition to the discharge effects with Hyraldite, by printing on a chlorate discharge alongside of the Hyraldite discharge, the chlorate discharge only discharging the Diamine Colours and having no effect on the Paranitraniline Red.

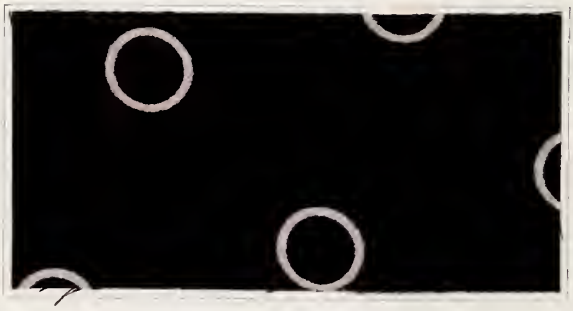
The following is a description of the process:

The material is dyed with Diamine Colours, in the usual manner, dried, and padded with the following solution of Beta Naphtol:

15 parts by weight of Beta Naphtol are stirred to a paste with
15 „ „ „ „ caustic soda lye of 77° Tw. and
30 „ „ „ „ Turkey-red oil, dissolved in warm water and brought up to 1000 parts by weight.

The dried goods are then developed, in the manner customary for Paranitraniline Red (see pages 108 and 109 of this book and also pages 352 and 353 of our book on "Cotton Dyeing"), with diazotised Paranitraniline C or Nitrazol C, rinsed well, and printed with the discharges.

After printing and drying, the materials are steamed in a small Mather & Platt, rinsed, and if necessary soaped.



The above pattern was produced in this manner by first dyeing with 2% Diamine Nitrazol Black B pat., mordanting with Beta Naphtol, and developing with Paranitraniline C.

White discharge: Hyraldite discharge, page 61.
Red discharge: Chlorate discharge, page 74.

Those Diamine Colours are in the first place suited for this method which may be fixed fast to washing by means of coupling and are easily dischargeable with chlorate discharge, as also with Hyraldite for white effects; we mention especially the following:

Diamine Nitrazol Brown BD, RD
Diamine Nitrazol Black B pat.
Diamine Jet Black pat. SS, RB, Cr, 00
Diamine Dark Blue B pat.
Diamine Bronze G pat.
Oxy Diamine Black pat. A, SA, JW, JEI, RR.

Other dischargeable Diamine Colours may besides be used for shading purposes (compare pages 46–60 and 74–75).

By first dyeing say with Diamine Nitrazol BD, bottoming with Beta Naphtol, and coupling with a solution of diazotised Metanitraniline B, which may be prepared according to the ordinary dyeing directions for Paranitraniline, brown shades of very good fastness are obtained which are discharged white with Hyraldite and yellow with chlorate discharge.

B. Dyeing and Padding previously Printed Goods.

The Diamine Colours are very largely used for dyeing and padding previously printed goods.

For a full description of the dyeing and padding we refer to the particulars contained in our book on "Cotton Dyeing", pages 313–320, and to Supplement No I thereto, pages 121–122 and 136–153, where the most suitable dyestuffs are mentioned for each special case.

Padding is mostly applied for pale shades, whereas darker shades are usually dyed in the jigger.

For the previous printing are principally used: Aniline Black, Paranitraniline Red and other Ice Colours, Alizarine Colours, Immedial Colours and Basic Colours.

The previous printing with Aniline Black is carried out principally according to the following two methods, viz.:

a) By first printing Aniline Black and then dyeing or padding with Diamine Colours.

b) By padding with Ferrocyanide-Aniline Black, printing a white resist for Aniline Black, then steaming and chroming, and finally dyeing or padding with Diamine Colours.

Articles previously printed with Ice Colours are usually produced by the following methods:

a) By padding with Beta Naphtol, printing on the diazo-compound, and dyeing or padding with Diamine Colours. (The latter may be added to the Naphtol preparation, the special padding with Diamine Colours being thus omitted; in this case, however, the possible changes of the Diamine Colours by the diazo-compound have to be taken into consideration.)

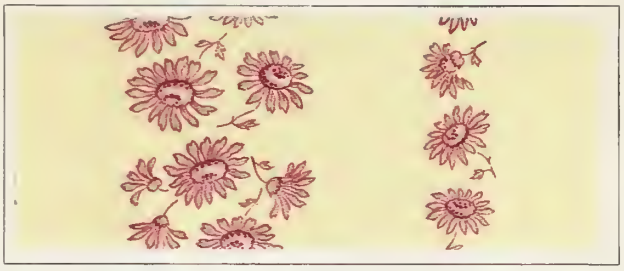
b) By developing of Ice Colours, discharging with Hyraldite, and dyeing or padding with Diamine Colours.

c) By previously printing white reserves for Ice Colours, developing the Ice Colours, and dyeing or padding with Diamine Colours.

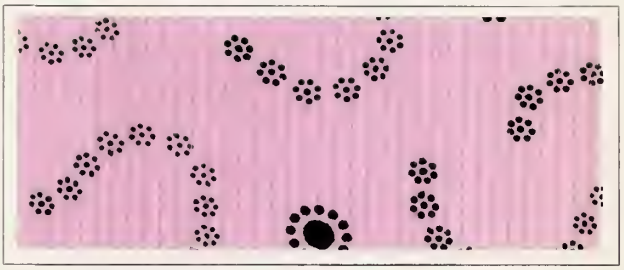
Diamine Colours padded on a printed bottom.

(According to instructions on page 78.)

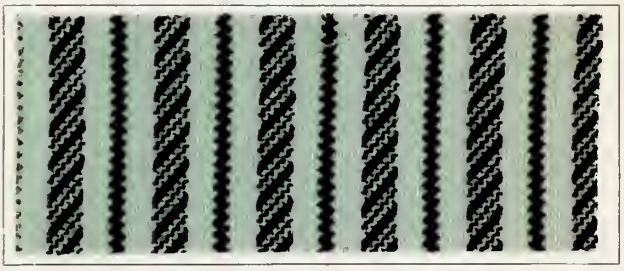
Diamine Yellow CP
Diamine Orange G.



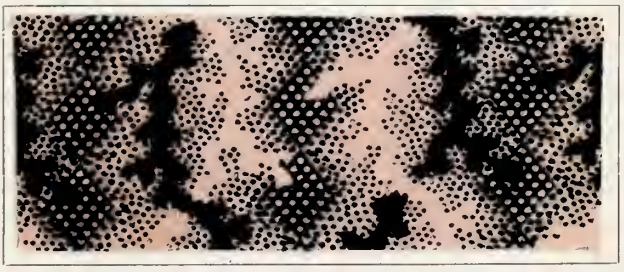
Diamine Rose GD.



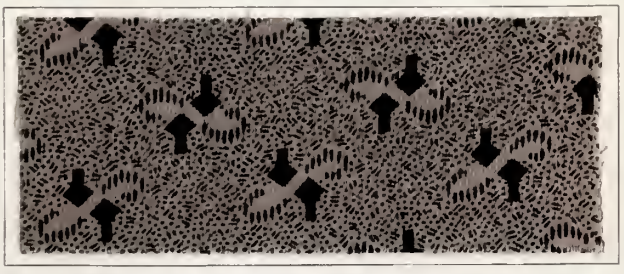
Diamine Sky Blue FF
Diamine Fast Yellow FF.



Diamine Orange G
Diamine Rose GD.



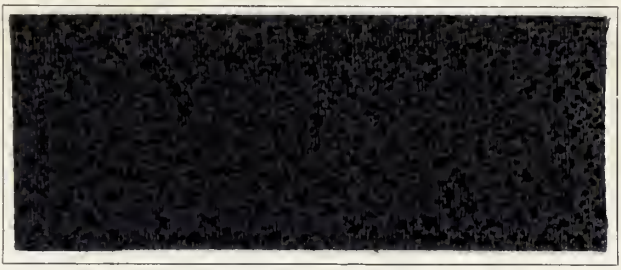
Diamine Fast Blue FFB
Diamine Yellow CP
Diamine Catechine B.



Diamine Colours dyed on a printed bottom.

(According to instructions on page 78.)

Diamine Fast Blue FFB
Diamine Catechine B
Diamine Yellow CP.



Diamine Fast Blue FFB
Diamine Rose BD.

Diamine Red 10B.

Diamine Green G.

Diamine Brown M
Diamine Catechine B
Diamine Catechine G.

C. Direct Printing.

The Diamine Colours may be fixed very well, especially in light shades, by direct printing and steaming.

Particularly the various brands of Diamine Fast Yellow are used very largely (for upholstery materials) and also Diamine Orange G and D in combination with other Diamine Colours for producing all kinds of mode shades.

For direct printing, the Diamine Colours are dissolved with the addition of phosphate of soda, and the cold solution is then stirred into a thickening consisting of solutions of blood albumen and tragacanth (see thickening AlT).

The print colours keep very well.

The following directions may be followed for printing:

For light shades.

5– 10	parts by weight of dyestuff dissolved in
300	„ „ „ „ water with the addition of
100	„ „ „ „ glycerine and
5– 10	„ „ „ „ phosphate of soda are boiled together and stirred until cold, then adding
590–580	„ „ „ „ thickening AlT.
1000	parts (approx.)

The colour may be reduced with thickening AlT in case still paler shades are desired.

For dark shades.

25	parts by weight of dyestuff dissolved in
310	„ „ „ „ water are boiled with the addition of
100	„ „ „ „ glycerine,
25	„ „ „ „ phosphate of soda and
440	„ „ „ „ tragacanth solution 65:1000, and stirred until cold, when
100	„ „ „ „ blood albumen 1:1 are added.
1000	parts (approx.)

After printing, the goods are steamed for 3/4 hour at 1/2–3/4 atm., then passed through cold water, and soaped, or finished immediately after the steaming.

To facilitate the dissolving of the Diamine Colours in the print colour it is well to first boil the dyestuff up with the tragacanth solution, particularly in the case of dark shades, and to add the albumen only after the solution has cooled off.

In using Diamine Brown M, B and 3 G, or Diamine Yellow N, it is recommended to add a small quantity of soap in dissolving the dyestuffs.

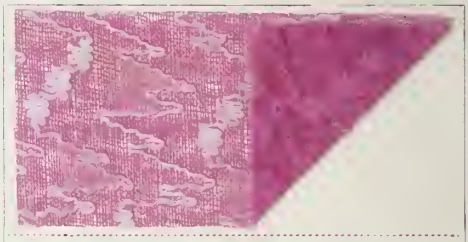
The addition of albumen may frequently be omitted in the case of light and medium shades, a sufficient fixation being obtained by the addition of phosphate of soda and the subsequent steaming. As however the slight addition of albumen does not affect the feel of the goods, it is advisable in every case to use the above thickening in printing.

Very handsome effects are obtained by first dyeing the goods with Diamine Colours in light shades, then printing dark shades on with Diamine Colours, and discharging white or in colours by means of Hyraldite.

By this means an imitation of the Indigo print style may be obtained, if for instance the goods are dyed with Diamine Sky Blue, printed with a combination of Diamine Sky Blue and Diamineral Blue R, and then discharged white or in colours by means of Hyraldite.

By printing Diamine Colours on to the backs of brocaded fabrics by means of a padding roller, very pretty effects may be obtained wich are very similar to woven effects.

1,5 parts Diamine Sky Blue F F pat.
per 1000 parts print colour.



1,5 parts Diamine Rose B D pat.
per 1000 parts print colour.

Print Colour:

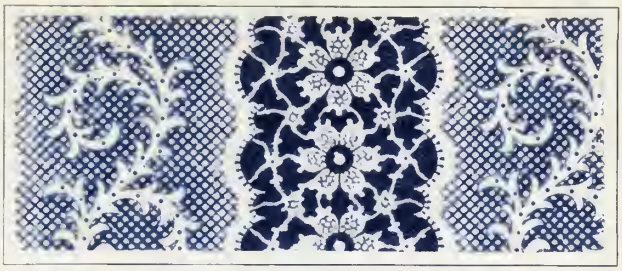
0,5 – 1,5	parts	by	weight	of	dyestuff are dissolved in
400	„	„	„	„	water, stirred to a paste with
150	„	„	„	„	tragacanth thickening 65 : 1000 and
50	„	„	„	„	wheat starch, and boiled with
400	„	„	„	„	water.
1000	parts	(approx.)			

After padding, the goods are dried, steamed for 15 – 20 minutes, and washed if necessary or immediately finished.

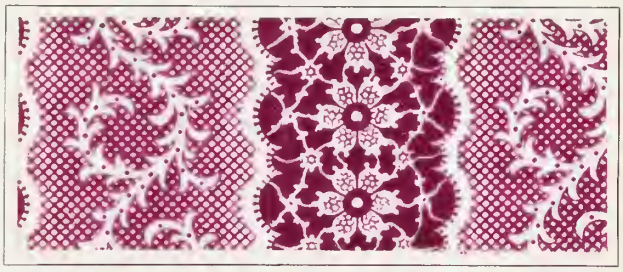
Direct Printing with Diamine Colours.

(According to instructions on page 79.)

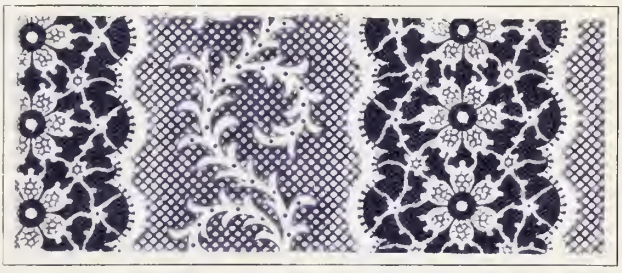
Diamine Sky Blue.



Diamine Rose BD.

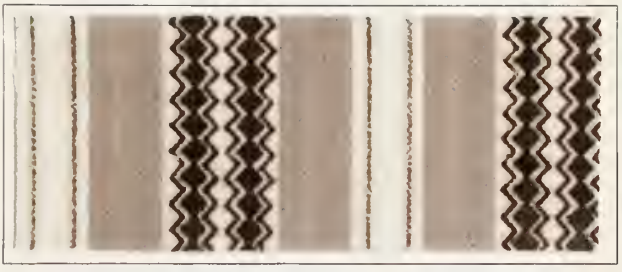


Diamine Violet N
Diamine Sky Blue.



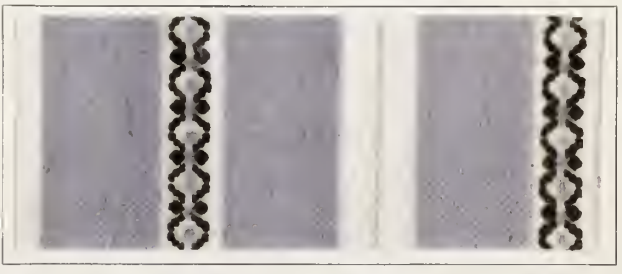
Light brown: Cotton Brown A, Oxy Diamine Black A, Diamine Orange G.

Dark brown: Cotton Brown A, Diamine Jet Black 00.



Grey: Diamine Jet Black 00.

Black: Logwood.



D. Special Print Styles produced with Diamine Colours.

Coloured Discharging on Mordanted Fabrics.

Coloured discharge effects may be obtained by adding any of the following Diamine Colours to the citric acid or tartaric acid discharge for mordants and dyeing as usual with mordant-dyeing colours.

Thioflavine S pat.
Diamine Fast Yellow A
Diamine Fast Yellow FF pat.
Diamine Fast Yellow B pat.
Diamine Yellow CP
Diamine Orange G
Diamine Orange B
Diamine Brown M pat.
Diamine Catechine G pat.
Diamine Catechine B pat.
Diamine Catechine 3G pat.
Diamine Brown 3G pat.
Diamine Brown B pat.
Diamine Scarlet B pat.
Diamine Scarlet 3B pat.
Diamine Brilliant Scarlet S
Direct Rose T
Diamine Heliotrope B
Diamine Bordeaux S
Diamine Blue BX pat.
Diamine Blue 3B pat.
Diamine Sky Blue pat.
Diamine Sky Blue FF pat.
Diamine Brilliant Blue G pat.
Diamine New Blue R pat.
Diamine Fast Blue FFB pat.
Diamine Steel Blue L pat.
Oxy Diamine Violet B pat.
Diamine Black BH pat.
Diamine Black HW pat.

Printing Diamine Colour Lakes on Linings.

The Diamine Colours are also very well suited for producing colour lakes for printing sleeve linings which are required to be fast to washing.

The lakes are obtained in a high degree of fineness, and in a thickening consisting of albumen and tragacanth solution they may be used for printing even the very finest stripes.

The property these lakes possess of fixing the basic colours fast to washing, is taken advantage of in order to render the lakes brighter.

A special advantage of these lakes is that they do not run during steaming.

The lakes are produced in the following manner:

1. 1 lb Diamine Colour is dissolved in
   2 gallons water, and
2. 1 lb barium chloride in
   2 gallons water.

Solution 2 is poured into Solution 1 whilst stirring, the mixture is then decanted, filtered and the resulting colour lake washed twice over. The wash waters are only very slightly tinted.

The Diamine Colours may also be precipitated with basic sulphate of alumina; to this end the Diamine Colours are dissolved in water containing some soda, and the solution of sulphate of alumina is added whilst stirring. The waste liquors are slightly tinted; the resulting colour lakes are brighter than those precipitated with barium chloride.

If it is desired to brighten the Diamine Colour lakes with basic colours, the following proportions give the most satisfactory results:

1. 1 lb Diamine Colour is dissolved in
   2 gallons water,
2. 1/4 lb basic colour in
   1 gallon water, and
3. 1 lb barium chloride or basic sulphate of alumina in
   2 gallons water.

Solution 3 is poured into Solution 1, and Solution 2 is added whilst stirring.

The print colour is prepared with

6 oz colour lake,
10 „ tragacanth 1:10
4 „ blood albumen 1:1 and
1/4 „ Turkey-red oil.

The goods are printed, steamed for 20 minutes at 1/2 atm., rinsed, and if necessary soaped at 40° C. (105 deg. F.).

Mercerisation Effects.

Crepon Effects.

This style may be produced in a very simple manner with Diamine Colours:

1. By printing on of caustic soda lye in which the Diamine Colours are dissolved.
2. By printing on of Diamine Colours thickened with gum solution, followed by a passage through caustic soda lye.
3. By printing caustic soda lye on to material dyed or padded with Diamine Colours.

The printing of Diamine Colours together with caustic soda lye is effected by printing the dyestuffs dissolved in the lye without the addition of any thickening. The material is then either immediately, or after a previous steaming, soured in diluted acetic acid without stretching, rinsed, and dried in the hanging room.

The advantage of printing Diamine Colours thickened with gum solution with a subsequent passage through caustic soda lye as compared with direct printing with caustic soda lye is, that more uniform results are obtained, and that the woollen blanket, which by this method does not come into contact with the soda lye, is not attacked.

The crepon effects are produced as follows:

Print Colour.

5 parts by weight of Diamine Colour are dissolved in
295 „ „ „ „ water,
100 „ „ „ „ glycerine and
600 „ „ „ „ gum solution 1:1.

1000 parts (approx.)

After printing, the goods are steamed for about ½ hour without pressure and then taken through cold caustic soda lye in a padding machine.

The lye cannot penetrate the printed parts, whilst the unprinted parts shrink.

On leaving the lye, the goods are given an air passage over a roller and pass on to the slanting side of an empty box, down which it slides in short folds; then follows another air passage over a second roller into another similar box, and if necessary in the same manner into a third box.

By this method of guiding, the goods are prevented from being pressed together by their own weight and are thus given time to shrink uniformly.

After the caustic lye passage the goods are rinsed without tension, if necessary with the addition of some acetic acid, and are then best dried in the hanging room.

For printing caustic soda lye on material dyed with Diamine Colours, a print colour is used consisting of

3 lbs burnt starch,
1 lb water and
6 lbs caustic soda lye of 75° Tw. } gently heated.

The fabric is printed with the thickened lye, and then rinsed well without stretching, if necessary with the addition of some acetic acid.

Caustic Lye Print Effects.

The production of caustic lye print effects is based on the greater affinity of the Diamine Colours to cotton previously treated with strong caustic lye than to ordinary cotton. The parts printed with lye are therefore dyed much deeper shades than the unprinted parts, resulting in dark patterns being obtained on a light ground of the same colour. Any of the Diamine Colours may be used for the dyeing.

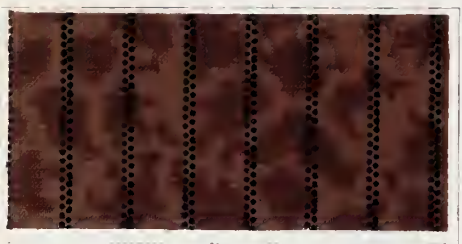
The patterns produced in this manner may be subsequently discharged at will, or other pattern may be printed on top of the same.

This style is produced by printing the undyed material with the caustic lye print paste described on the preceding page, drying at a moderate temperature, then washing well, and dyeing.

The washing, which is resorted to in order prevent the lye from polluting the dye liquor, does not impair the effects.

The printed goods are best dyed in the jigger, the dyeing operation being shortened as much as possible; as a rule 1/2 hour will be sufficient for dyeing (1/4 hour cold and 1/4 hour warm).

As the bath can always be used over again, it should be charged with a somewhat larger quantity of dyestuff than usual, in order to curtail the dyeing process.



Dyed with { Diamine Red 10B pat. / Diamine Black BH pat. / Diamine Yellow CP
Printed with Aniline Black.

Dyed with { Diamine Dark Green N pat. / Diamine Yellow CP
Printed with Aniline Black.

Dyed with { Diamine Black BH pat. / Diamine Fast Yellow A / Diamine Brown M pat.
Printed with Aniline Black.

Damask Print Effects on Goods dyed with Diamine Colours.

Imitations of damasks may be obtained by printing zinc white or similar white earth colours (also viscose) on fabrics dyed with Diamine Colours

Dyed with 0,1 % Diamine Catechine B pat.
0,02 % Diamine Yellow C P.

Dyed with 0,7 % Diamine Rose B D pat.
0,2 % Diamine Yellow C P.

The dyed goods are printed with the following zinc white print colour:

4	lbs	zinc white and
2	„	water are ground well with
1/2	„	glycerine and
2 1/4	„	olive oil in a mill, and
3 1/4	„	egg albumen solution 1:1 added,
12	lbs	(approx.)

then taken through a Mather & Platt, and finished. The colour must be well ground in a ball mill and printed on with a rotating brush.

III.

Immedial Colours.

A. Direct Printing.

The Immedial Colours have proved of great value for the printing of light and medium shades and are very widely used for printing grey, blue and mode shades.

Light shades may be printed simply with the addition of caustic lye.

For somewhat deeper shades an addition of some bisulphite of potassium and Hyraldite is useful in order to prevent the rollers from becoming blackened.

Print colours prepared in this manner do not affect copper and brass rollers and may be printed just like any other colours. They offer the great advantage of producing exceedingly fast and cheap print effects at a low cost.

The following are the most important methods of direct printing:

a) For light shades: Immedial Colours with the addition of caustic soda lye;

b) For light and medium shades: Immedial Colours with the addition of caustic lye, bisulphite and Hyraldite;

c) For blue shades: Immedial Indone with the addition of caustic lye, bisulphite, Hyraldite and grape sugar.

Pale Shades printed with Caustic Lye.

2½ oz	Immedial Cutch G or some other Immedial Colour are stirred to a paste with
2 lbs 4	„ caustic soda lye of 75° Tw.;
1 lb	water are then added, and the whole is stirred into
6 lbs 9½	„ British gum 1:1.
10 lbs (approx.)	

The printed goods are steamed at 102–104° C. (215–220 deg. F.) in a small Mather & Platt, then rinsed, and dried.

Pale and Medium Shades printed with Caustic Lye, Bisulphite and Hyraldite.

	4	oz dyestuff are stirred with
	5	„ sodium bisulphite of 70° Tw. and
1 lb		„ water of 140–160 deg. F., mixed with
2 lbs	8	„ caustic soda lye of 75° Tw. and heated to 60–70° C. (140–160 deg. F.) until complete solution sets in.
		Then
	1½	„ Hyraldite A are dissolved by warming in
5 „	13½	„ British gum 1:1 and stirred up with the dyestuff solution.

10 lbs. (approx.)

After printing, the goods are steamed in a small Mather & Platt at 215–220 deg. F. as stated above, then rinsed, and dried.

Blue Shades with Immedial Indone.

These print colours likewise keep very well and do not affect copper or brass rollers.

	4	oz Immedial Indone are stirred together with
	5	„ bisulphite of sodium of 70° Tw. and
3 lbs		„ water of 140–160 deg. F., mixed with
	4	„ grape sugar and
	5	„ caustic soda lye of 75° Tw. and heated to 120–140 deg. F. until completely dissolved.
		Then
	1½	„ Hyraldite A are dissolved by warming in
5 „	12½	„ thickening JM* and stirred up with the dyestuff solution.

10 lbs (approx.)

* Thickening JM.

330	parts	by	weight	of	British gum are heated with
330	„	„	„	„	gum 1:1,
310	„	„	„	„	water and
30	„	„	„	„	Turkey-red oil.

1000 parts (approx.)

After printing, the goods are steamed, washed, and dried.

The two first patterns on table XI have been prepared according to these directions.

Grey with Immedial Black, printed with the addition of Bisulphite and Hyraldite.

I.	½ – 1 lb	Immedial Black NN conc. are heated with
	4 – 8 lbs	bisulphite of potash of 70° Tw. to 140–160 deg. F.;
	7 – 10 „	Hyraldite A and
	6 „	water are added, the solution being then cooled off completely.
II.	50 lbs	British gum 1:1 are stirred to a paste with
	15 „	potash dissolved in
	10 „	water (warm), and cooled off.

No I is then stirred into No II.

The print colour keeps well and is printed with the ordinary copper or brass rollers which are not affected thereby.

After printing, pale shades are steamed for a few minutes and medium or dark shades for about ½ hour with very dry steam; the goods are thereupon washed, and soaped. It is not necessary to chrome the steamed goods.

The third pattern on table XI was prepared in this manner.

Owing to its simplicity and the excellent fastness of the shades of Grey obtained therewith, this method is already applied very largely in practice.

Grey with Immedial Black, printed with the addition of Bisulphite and Acetate of Chrome.

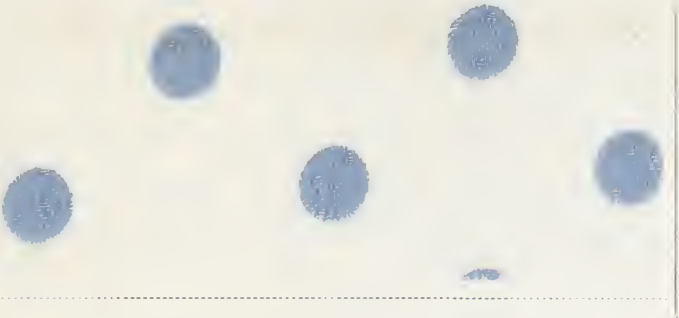
This method is not only suitable for printing Immedial Black by itself, but more especially also for combinations with chrome colours such as Alizarine Blue CS, Anthracene Yellow GG and BN etc., which may be used at will for shading the grey. It is also very suitable for other Immedial Colours. The printing rollers are not affected by these colours either.

The print colours are prepared as follows:

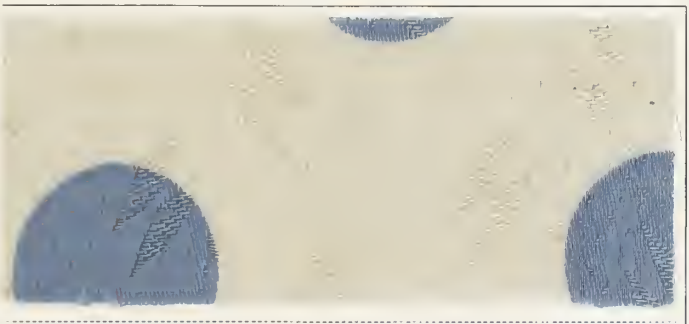
1	2 lbs	Immedial Black NN conc., NNG conc., NBB conc., V extra, etc. are left standing for 12 hours with
3	6 „	bisulphite of 70° Tw., heated with
36 – 27	„	water to 140–160 deg. F. and then thickened with
	50 „	British gum thickening 1:1. When cold,
10 – 15	„	acetate of chrome of 28° Tw. are added.
	100 lbs	(approx.)

After printing, the goods are steamed for ¾ hour at ½ atm. pressure, then washed, and soaped.

Immedial Colours printed with Bisulphite of Soda and Hyraldite A.



Immedial Indone BBF conc. pat. (Instructions page 90.)



Immedial Indone BBF conc. pat. (Instructions page 90.)

Grey: Immedial Black NN conc. (Instructions page 91.)
Black: Aniline Black.

B. Discharging Immedial Colours.

The Immedial Colours may be discharged similarly to Indigo by means of strong chlorate discharges, the dyed pieces being printed with chlorate discharges, steamed in a Mather & Platt, taken through warm diluted caustic soda lye, and washed.

Full particulars of the dyeing with Immedial Colours are to be found in our pamphlet No 2488, "The Dyeing of Immedial Colours on Piece-Goods" as also in our book on "Cotton Dyeing" pages 329—344 and 355—356, and pages 122—126 and 137—153 of Supplement No I thereto, to which reference is here made.

All Immedial Colours are adapted for discharging with chlorate discharge.

The dyed goods, when dried are printed with the following chlorate discharge:

17 1/2	lbs	chlorate of soda are dissolved in
24	„	water, mixed with
7	„	China clay rubbed down in
7	„	water, then stirred to a paste with
25	„	British gum, and boiled. Whilst cooling,
12 1/2	„	finely powdered tartaric acid are added at about 160 deg. F., and, when cold,
7	„	ferricyanide of ammonia solution of 42° Tw.
100 lbs (approx.)		

* Ferricyanide of Ammonia Solution of 42° Tw.

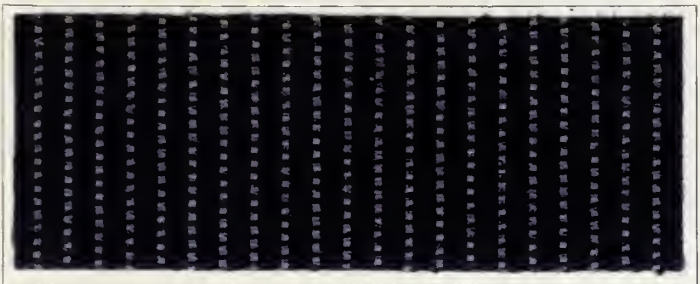
10 lbs ferricyanide of potash and
7 „ sulphate of ammonia crystals are dissolved by boiling in 2 gallons water, and allowed to cool off.

The clear solution is used after decanting from the potassium sulphate which crystallises out.

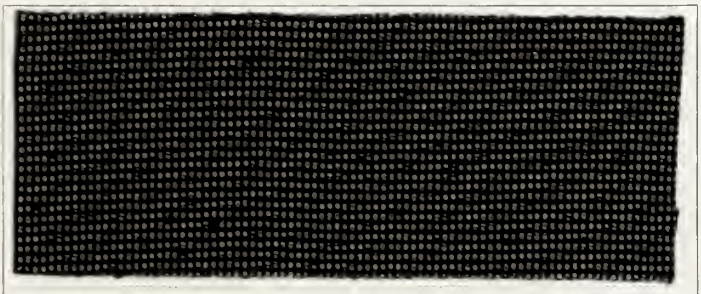
The printed goods are dried very thoroughly and steamed for 1—2 minutes in a Mather & Platt with very hot steam; they are then passed through dilute caustic soda lye of about 120 deg. F. (1/2—1 lb caustic soda lye of 75° Tw. per 10 gallons liquor), rinsed thoroughly, or soaped, and dried.

Immedial Colours discharged on Moleskins.

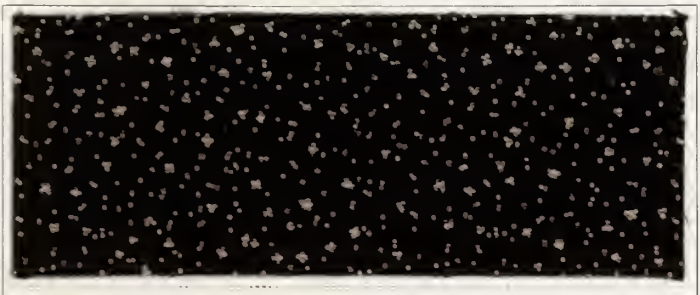
(According to instructions on page 93.)



Immedial Indone BF conc. pat.
Immedial Direct Blue B pat.



Immedial Black NN conc.



Immedial Dark Brown A pat.

Immedial Black NN conc.

C. Reserve Printing with Immedial Colours.

For reserving Immedial Colours, metallic salts are used, which prevent these dyestuffs staining the goods. Of the various metallic salts suitable for this purpose, sulphate of zinc (white vitriol) is the most effective in its resisting effect, and gives the best results in the following zinc resist:

4½ lbs of gum solution 1:1,
2½ „ „ China clay paste 1:1 and
3 „ „ sulphate of zinc are heated until the sulphate of zinc becomes completely dissolved.
10 lbs (approx.)

A roller with deep engravings is used to advantage for printing the reserve, after which the goods are well dried, and then dyed.

Immedial Indone BBF conc. pat.

Immedial Indone R conc. pat.

Any padding machine provided with a good-sized trough, or a small roller-box provided with squeezing rollers, may be used; care has only to be taken that no brass or copper parts come into contact with the dye liquor. The squeezing rollers should be covered with cloth, the lower roller preferably running partly in the liquor and the goods being passed through the liquor in such a manner that the face of the material comes into contact with the lower squeezing roller.

The dyebaths are charged approximately in the following proportions:

for pale	medium	dark shades:	
approx. 1½ lbs	approx. 2½ lbs	approx. 3 lbs	of Immedial Colour
1½ „	2½ „	3 „	„ sodium sulphide crystals
3 „	3 „	3 „	„ soda ash
3 oz	3 oz	3 oz	„ Turkey-red oil
10 lbs	10 lbs	10 lbs	„ tragacanth solution 65:1000

and made up with water to 10 gallons.

For pale and medium shades it is unnecessary to heat the liquor, whereas for deep shades it may be heated to about 70–80° C. (160–175 deg. F.).

The goods, when printed with the resist and dried, are run once slowly through the liquor, squeezed off, and then given an air passage over several guiding rollers they are then rinsed thoroughly, acidulated (with ½ lb sulphuric acid per 10 gallons water), washed, and soaped.

IV.

Azo Colours produced on the Fibre.

(Ice Colours.)

Azo Colours are produced on the fibre by first impregnating the goods with a solution of Naphtol, then carefully drying them, and applying diazo solutions either by dyeing or printing processes.

The most important of these Azo Colours is Paranitraniline Red (Para Red or Ice Red) produced with Beta Naphtol and diazotised Paranitraniline. Fine cutch shades may be obtained by the action of copper combinations on the dyed or printed red, or by adding such combinations to the Naphtol or diazo solution. Of late, Para bistre shades produced with Chrysoïdine and Bismarck Brown (instead of Naphtol) and diazotised Paranitraniline are being used to a considerable extent.

Paranitraniline Red.

(Para Red or Ice Red.)

Paranitraniline Red is one of the most important colours for calico printing by reason of its brightness of shade, properties of fastness, and simple method of application.

The following methods are usually applied:

A. Direct printing
B. Reserve printing
C. Discharge printing.

In each case the goods are first impregnated with Naphtol as described below. Printing of thickened Naphtol solutions is no longer resorted to.

1. Impregnating with Naphtol Solution.

The bleached and dried fabric is padded with the following Naphtol solution:

2 lbs 4 3/4 oz Beta Naphtol and
3 1/4 „ Red Developer C } or 2 1/2 lbs Naphtol RC
are stirred with
2 „ 8 „ caustic soda lye of 75° Tw., over which are poured
8 „ hot condensed water;
5 „ castor-oil soap in
25 „ hot condensed water are then added, and the whole
is brought up to
10 gallons and applied lukewarm.

The Naphtol solution prepared at a time should not exceed the day's requirements.

Red Developer C or Naphtol RC are added in order to give the red a pleasing bluish cast. Any larger addition of Red Developer C will be without beneficial effect. The castor-oil soap also gives the red a more bluish and brighter cast.

If a more yellowish cast of red is required, the addition of Red Developer C is entirely omitted. and the operation is carried out with 2 1/2 lbs Beta Naphtol exactly according to the above directions.

The goods are best impregnated with the lukewarm Naphtol solution on a two roller padding machine, or, in the case of thick material, on one with three rollers. The material is passed over a tentering frame and over an opener in order to get out all creases. The padding machine should be provided with a trough, through which the pieces, according to their thickness, are passed over 2 or 3 guiding rollers

in order to become fully impregnated. They are then well squeezed off by means of squeezing rollers covered with cloth in order to remove any superfluous Naphtol and thus as far as possible prevent subsequent rubbing off. The pressure is regulated by a double lever.

After impregnating, the pieces are immediately dried, great care being taken that they do not crease and that the machines are not stopped. The best way is to dry the goods on a hot-flue, at a temperature of 50° (120 deg. F.), arranged immediately behind the padding machine; in the absence of a hot-flue the goods may also be dried on a tentering machine or on a cylinder drying machine, the first 2–4 cylinders of which should be covered with cloth. The pieces should come out from the drying machine thoroughly dried, but not very hot, the disadvantage of drying too hot being that the Naphtol is apt then partly to sublimate from the goods.

Pieces prepared in this manner should if at all possible be developed with the diazo solution on the same day, as by lying even for a short time only they become brownish and the then resulting red is not only duller in shade, but in the case of reserve or discharge printing the white effects do not turn out so well.

According to Lauber and Caberti, goods prepared with Beta Naphtol may be kept for some time without any ill effects if the preparation contains antimony compounds; for instance, about 1½–2 lbs antimony paste and 2–3 lbs glycerine would be required per 10 gallons. The red becomes however a little more yellowish by the addition of antimony compounds.

The addition of 2–5 oz sulphite of potash of 64° Tw., or 2½ lbs glucose per 10 gallons will also render the Naphtol preparation more stable.

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2. Developing the impregnated Goods.

A. Direct Printing.

The best thickening agent is tragacanth solution, but starch tragacanth and flour tragacanth thickening may also be used to advantage for thick print colours. British gum, Leiogomme, dextrine and ordinary gum are not so well adapted.

Print Colour I.

2	lbs	1½	oz	of Paranitraniline C are dissolved in
9	„	3½	„	„ boiling hot water with the addition of
5	„			„ hydrochloric acid of 36° Tw., then cooled off to 10° C. (50 deg. F.) by adding
20	„	11	„	„ water and ice; then
11	„	8	„	„ nitrite of soda solution 1:1 are added in one lot whilst stirring, the solution is left standing for 5–10 minutes, and, when clear, filtered through a cloth into
44	„			„ tragacanth solution or thickening M. Immediately before use,
2	„	8	„	„ acetate of soda dissolved in
5	„			„ water are added cold.
100	lbs	or	10	gallons (approx.)

The Paranitraniline must be completely dissolved by means of hydrochloric acid and boiling water. If the water is not hot enough, so as not to fully dissolve the Paranitraniline, the bath must be heated until complete solution results. By adding the cold water and ice the hydrochloride of Paranitraniline separates in form of a fine magma. Ice may be dispensed with if the water is sufficiently cold.

As free mineral acids prevent the coupling of the diazo compounds with the Naphtol, the hydrochloric acid contained in the diazo solution must be bound by adding some acetate of soda. By means of Methyl Orange paper it is easy to ascertain whether a sufficient amount of acetate of soda has been added, the paper turning red as long as free mineral acids are still present; in the absence of mineral acids, the paper will retain its yellow colour.

As the diazo solution does not keep so well when once the free mineral acid has been neutralised, the acetate of soda should not be added until immediately before using the diazo solution, and only small quantities of the print colour containing acetate of soda should be kept on stock.

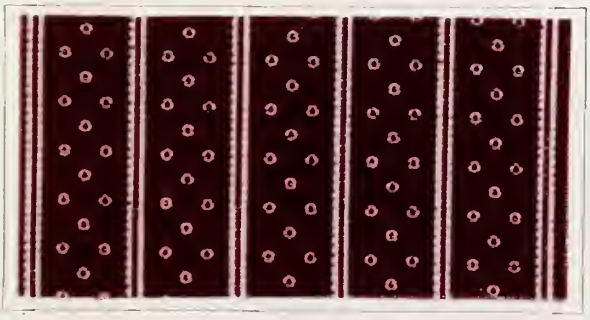
Print Colour II.

This print colour differs from the No I in so far as the Paranitraniline is first mixed with the nitrite and then only with the muriatic acid, which method of working is sometimes given the preference.

2 lbs 1½ oz of Paranitraniline C are stirred with
5 „ „ water; at about 10° C. (50 deg. F.)
11 „ 8 „ „ nitrite of soda solution 1:1,
14 „ 14½ „ „ water and
10 „ „ ice are added,
5 „ „ hydrochloric acid of 36° Tw. being thereupon added gradually and the clear filtered solution stirred into
44 „ „ tragacanth solution 65:1000 or thickening M. Immediately before use,
2 „ 8 „ „ acetate of soda dissolved in
5 „ „ water are added cold.

100 lbs or 10 gallons (approx.)

(Compare our above remarks regarding the addition of acetate of soda.)



Red: Paranitraniline Red C (Print Colour II).

Print Colour III, with Nitrazol C.

Nitrazol C, representing the stable form of the diazo combination of Paranitraniline, is to be preferred to the latter if the diazotising for any reason should cause difficulties in printing. Nitrazol C offers the special advantage that it renders the use of ice superfluous.

The print colour with Nitrazol C is prepared in the following manner:

9 lbs Nitrazol C are well mixed with
29½ „ cold water and after standing for about ½ hour the solution is filtered through a cloth. Immediately before use it is mixed with
50 „ tragacanth solution 65 : 1000 or thickening M, in which
3 „ acetate of soda have been previously dissolved. Finally,
3½ „ caustic soda lye of 32° Tw. diluted with
5 „ water are gradually stirred into the paste.

100 lbs or 10 gallons (approx.)

Methyl Orange paper must not become reddened by this print colour; if this be the case, a little more diluted caustic soda lye should be carefully added (see page 101).

Red: Nitrazol C (Print Colour III).
Black: Logwood Black.

The goods printed with diazotised Paranitraniline C or Nitrazol C are dried well and then run full-width through a roller-box, the first compartments of which are filled with hot water. It is useful to add some hydrochloric acid to the first compartment to prevent the excess of diazo compound from reacting on the unprinted parts prepared with Naphtol and thus staining the white. The last compartment is provided with sprinklers for pure water to rinse the goods effectively. Finally, the goods are soaped in rope form for ½ hour at about 50° C. (120 deg. F.), rinsed, and dried. They are further if necessary chlorinated in order to clean the white, whereby the red also becomes still more brilliant.

Paranitraniline Red with Accompanying Colours.

For the printing of other shades along with Paranitraniline Red, either basic colours with tannin, or Diamine Colours with albumen, as fixing agent, may be used.

Basic colours may be printed according to the following directions, and most of the other basic colours may be applied in a like manner, as indicated below.

Blue.

6	parts	by	weight	of	Crystal Violet 5B bluish
10	„	„	„	„	New Methylene Blue N
99	„	„	„	„	acetic acid of 8° Tw.
775	„	„	„	„	starch tragacanth thickening T
30	„	„	„	„	tartaric acid
80	„	„	„	„	tannin-acetic acid 1:1.
1000	parts	(approx.)			

Yellow.

30	parts	by	weight	of	Thioflavine T
200	„	„	„	„	acetic acid of 8° Tw.
350	„	„	„	„	starch tragacanth thickening T
170	„	„	„	„	water
250	„	„	„	„	tannin-acetic acid 1:1.
1000	parts	(approx.)			

Green.

20	pars	by	weight	of	Thioflavine T
15	„	„	„	„	New Methylene Blue N or GG
250	„	„	„	„	acetic acid of 8° Tw.
415	„	„	„	„	starch tragacanth thickening T
300	„	„	„	„	tannin-acetic acid 1:1.
1000	parts	(approx.)			

After printing, the goods are steamed for 3 to 5 minutes in a small Mather & Platt; in case the Naphtol preparation did not contain any antimony they are then taken full-width through a bath of about 50° C. (120 deg. F.) containing 8 oz tartar emetic and 1 lb chalk per 10 gallons. Finally, the goods are rinsed full-width, lightly soaped if necessary, washed, and dried.

Along with basic colours, Diamine Colours may also be printed on goods prepared with Naphtol; for instance:

For Yellow:	25	parts	by	weight	of	Diamine Fast Yellow FF pat.
„ Blue:	25	„	„	„	„	Diamine Sky Blue FF pat.
„ Green:	10	„	„	„	„	Diamine Fast Yellow FF pat.
	10	„	„	„	„	Diamine Sky Blue FF pat.

The print colour consists approximately of

25	parts	by	weight	of	Diamine Colours
410	„	„	„	„	water
440	„	„	„	„	tragacanth solution 65:1000
25	„	„	„	„	phosphate of soda
100	„	„	„	„	blood albumen solution 1:1.
1000	parts (approx.)				

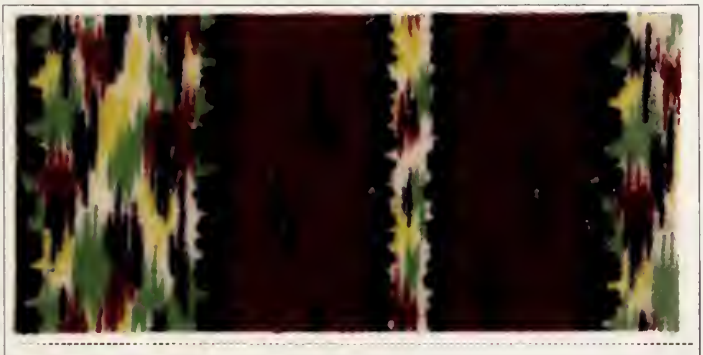
After printing, the goods are steamed for 3 to 5 minutes in a small Mather & Platt washed full-width, lightly soaped if necessary, washed, and dried.

Paranitraniline Red printed alongside of Basic Colours.

(According to instructions on page 103.)

Red: Paranitraniline Red.
Blue: { New Methylene Blue N pat.
Crystal Violet 5B bluish.

Red: Paranitraniline Red.
Green: { Brilliant Green crystals extra
Thioflavine T pat.



Red: Paranitraniline Red.
Black: Logwood Black.
Green: { New Methylene Blue GG pat.
Thioflavine T pat.
Yellow: Paraphosphine G pat.

B. Reserve Printing.

By printing suitable resists on fabrics prepared with Beta Naphtol, and by subsequent developing with diazo solutions, very fine illumination effects are obtained; of effects produced in this manner, those with Paranitraniline C or Nitrazol C have found special favour as substitutes for the more complicated Turkey-red discharge style.

As described on page 99, the goods are first impregnated with Beta Naphtol and, when dried well, immediately printed with the resist.

The following come in the first place into consideration as white resists:

a) Sulphite of potash
and
b) Tin crystals.

Coloured reserves are obtained with

a) Tin crystals mixed with dyestuffs which are not discharged by same;
b) Sulphite of potash with the addition of suitable dyestuffs;
c) Tannin, which is frequently used together with basic colours for coloured reserves by reason of its strong resisting effect.

White Reserve KS.

730 parts by weight of sulphite of potash of 90° Tw. are stirred to a paste with
270 „ „ „ „ dry British gum, and gently heated.

1000 parts (approx.)

White Reserve Z.

160 parts by weight of light burnt starch are heated with
160 „ „ „ „ water, then
100 „ „ „ „ tartaric acid are added, and, when cold,
580 „ „ „ „ tin crystals.

1000 parts (approx.)

Reserve with Ammonium Chloride. A pleasing effect in form of a kind of half-resist is obtained by printing ammonium chloride before developing.

Reserve with Ammonium Chloride.

100 parts by weight of ammonium chloride (sal ammoniac)
400 „ „ „ „ water
500 „ „ „ „ tragacanth solution 65:1000.

1000 parts (approx.)

The resist is printed on the fabric prepared with Beta Naphtol, either by itself or over other accompanying colours, and the treatment is continued as in the case of the other resists.

After the printing of the resists, the pieces are well dried and, as described further on (page 107), developed in the diazo solution without any previous steaming.

Basic colours are frequently applied together with tin crystals in the following manner for the production of coloured resist effects:

Yellow Reserve:

28 parts by weight of Thioflavine T
407 „ „ „ „ starch tragacanth thickening T
160 „ „ „ „ acetic acid of 8° Tw.
35 „ „ „ „ glycerine
20 „ „ „ „ tartaric acid 1:1
84 „ „ „ „ tannin-acetic acid 1:1
266 „ „ „ „ white reserve Z (page 105).

1000 parts (approx.)

Green Reserve:

15 parts by weight of Thioflavine T
15 „ „ „ „ Solid Green crystals 0;
otherwise same as for the Yellow Reserve.

Blue Reserve:

20 parts by weight of New Methylene Blue N
10 „ „ „ „ Crystal Violet 5B bluish;
otherwise same as for the Yellow Reserve.

A further list of basic colours suitable for these coloured discharges will be found on page 72.

For coloured sulphite reserves, albumen colours are used.

Tannin Reserves. In addition to tin crystals, tannin is also used of late to a considerable extent as a resist and acts at the same time as a fixing agent for the basic colours contained in the resist. The coloured effects produced in this manner are distinguished for their great brightness and satisfactory fastness to washing.

The subjoined pattern has been produced by printing the goods prepared with Naphtol with the following dyestuffs and developing in the solution of the Diazo Paranitraniline:

Green Reserve:

12 parts by weight of Thioflavine T and
12 „ „ „ „ Brilliant Green crystals extra are dissolved in
200 „ „ „ „ acetic acid of 8° Tw. and
40 „ „ „ „ tartaric acid 1:1; the solution is mixed with
486 „ „ „ „ starch tragacanth thickening T and
250 „ „ „ „ tannin acetic acid 1:1 are added.

1000 parts (approx.)

Blue Reserve:

14 parts by weight of New Methylene Blue R
16 „ „ „ „ New Blue 7556;
otherwise same as for the Green Discharge

Claret:

Diazo Alpha Naphtylamine.

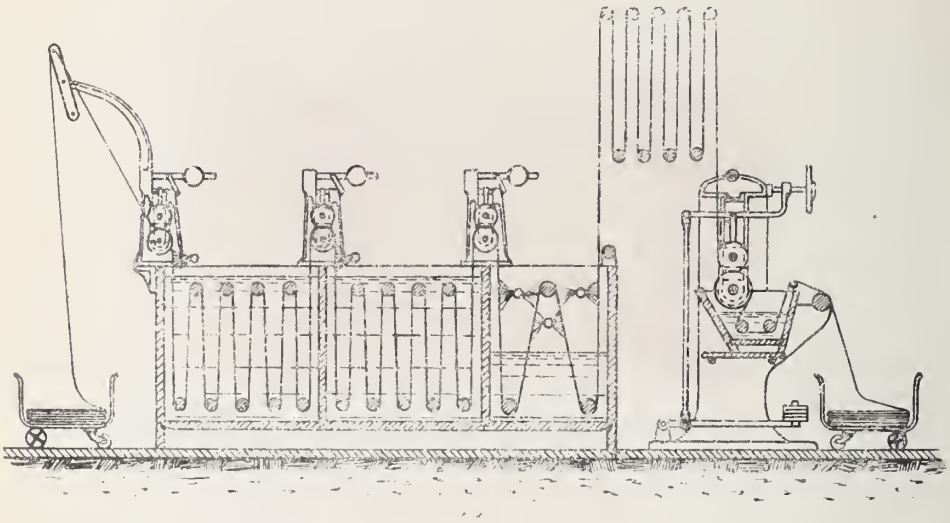
The pieces printed with the coloured reserves are given a short passage through the Mather & Platt in order to fix the colours prepared with tannin.

Prolonged steaming should be avoided, as it will affect the red which has subsequently to be developed.

The addition of antimony paste to the Naphtol preparation (described on page 100) proves of very good service for this style, as the colours become thereby faster to washing; the red however turns out a little yellower. Excessive quantities of antimony have a reserving effect, so that some care has to be exercised in this respect.

Developing Reserve-printed Goods.

The goods prepared with Naphtol and printed with resists are dried again thoroughly and then taken through a machine similar to the following sketch.



This machine consists of a two-roller padding machine combined with an arrangement for an air passage and a rinsing box.

The lower squeezing roller of the padding machine is provided with an India rubber coating.

The trough of the padding machine holds only 5–10 gallons liquor, so that the diazo solution contained therein may be used up rapidly by the dry fabric and be constantly replaced by fresh solutions. This has proved to be advisable, as the liquor is very much contaminated through parts of the resist peeling off; for the same reason it is advisable to run off the contents of the trough entirely after 40–50 pieces have passed through, and then to charge it with a fresh liquor.

It is as a rule unnecessary to cool the trough from outside by means of ice or cold water.

The diazo solution is made to run into the trough through a pipe which traverses it in its whole length and which is perforated to the extent of the full width of the goods. The holes must be so arranged that the solution does not spurt straight on to the goods passing through.

It is recommended to arrange a heated drying plate or drum in front of the padding machine, over which the pieces are passed in order that they may reach the developing bath in as dry condition as possible.

For developing, both Paranitraniline and Nitrazol may be used, directions for working with both of which are given in the following.

Developing with Paranitraniline C.

Mix well

Liquor A.

2 lbs	13 oz	Paranitraniline C in a bowl with
2 gallons		boiling hot water and dissolve completely by adding
	2¼ quarts	hydrochloric acid of 36° Tw.*) Stir this solution into
5 „	(approx.)	cold water, whereby the hydrochloride of Paranitraniline separates in the shape of yellow flakes. Then add
10 lbs	(approx.)	ice for cooling, and when the temperature has fallen to about 50–60 deg. F., add in one lot whilst stirring
1 gallon	2¼ quarts	solution of nitrite of soda 1:10. Then dilute the clear solution, obtained after a few minutes, to
15 gallons		by the addition of cold water.

In a second vessel dissolve

Liquor B.

6 lbs	acetate of soda in
4 gallons	water, and dilute to
5 gallons	by the addition of water.

For developing, use

3 parts of Liquor A and
1 part of Liquor B**).

Developing with Nitrazol C pat.

In a suitable vessel dissolve

Liquor A.

16 lbs	Nitrazol C pat. in
5 gallons	water at ordinary temperature and
	dilute to
15 gallons	by addition of water.

In a second vessel dilute

Liquor B.

1 quart	caustic soda lye of 75° Tw. in
2 gallons	water, then mix with
6 lbs	acetate of soda dissolved in
2 gallons	water, and dilute to
5 gallons	by the addition of water.

In this case also, use for developing

3 parts of Liquor A and
1 part of Liquor B**).

*) Paranitraniline C mixed with boiling hot water dissolves completely on the addition of hydrochloric acid without further heating being necessary; if however the water is not hot enough, the Paranitraniline will not be entirely dissolved on the addition of hydrochloric acid, and the mixture has to be heated until complete solution results.

**) Methyl Orange paper must not become reddened by the diazo solution charged with acetate of soda; if this be the case, some more acetate of soda, or diluted caustic soda lye, should be carefully added (see page 101).

The trough of the machine is filled with the developing liquor, the temperature of which should not exceed 14° C. (55 – 60 deg. F.), and during the passage of the goods, fresh diazo solution is added in proportion to the quantity consumed (3 parts A and 1 part B) so as to maintain the same consistency of the liquor right through.

After passing the developing liquor and the squeezing rollers affixed to the end of the trough, the pieces are guided over wooden rollers a distance of a few yards through the air to allow the colour to develop completely.

The goods are then taken full-width through several roller-boxes, the first of which is provided with sprinklers. The contaminated water in this first box is rapidly run off through openings at the bottom, so that the goods always remain in contact with pure water. The second and if necessary a third box are completely filled with water supplied through a pipe at the bottom of the box, the latter being provided with an overflow pipe.

Finally, the goods are squeezed off full-width, in order to prevent any spotting from coloured resists which may have been printed along with the resist for white, and then dried.

Goods printed merely with white resists before drying are washed in rope form for another ½ hour in a soap bath (3 oz per 10 gallons) at 40 – 50° C. (105 – 120 deg. F.), and rinsed.

C. Discharge Printing.

By means of discharge printing with Hyraldite, white and coloured discharge effects on Paranitraniline Red are obtained in a much simpler manner than according to the reserve printing method.

The following are the principal advantages of discharge printing with Hyraldite as compared with reserve printing:

As the goods may be dyed for stock immediately after the mordanting and be discharged at will later on, the unstability of the Naphtol preparation, which is very unpleasantly noticeable in the reserve printing method, does not come into consideration.

The dyeing of plain goods is simpler than that of goods printed with resists. In particular the stability of the resists with regard to the duration of the passages need not be taken into consideration.

Peeling off of the reserves and the rapid decomposing of the diazo solution caused thereby is prevented.

The White obtained with Hyraldite is superior to that obtained by reserve printing, particularly in the case of full shades.

The Hyraldite discharges possess also the great advantage of not affecting the goods in the least, whereas in the case of tin crystals reserves a tendering of the fibre and also of the back cloth is scarcely to be prevented.

Finally, in using Hyraldite it is possible to print Aniline Black also along with white and coloured discharges.

The dyeing with Paranitraniline Red is carried out exactly as described on page 107 for reserve printing; the printing of the resists is merely omitted and thus no spotting off to be feared.

For white and coloured discharges with Hyraldite, the same discharges come into consideration as described for Diamine Colours on pages 61—68. The subsequent treatment is also the same.

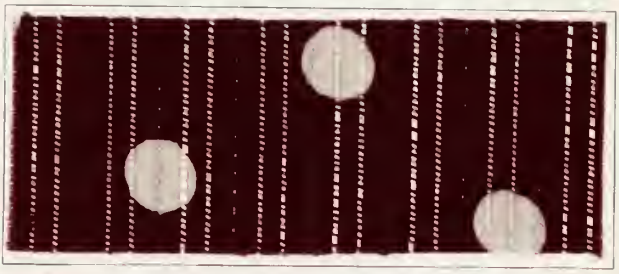
Paranitraniline Red discharged with Hyraldite pat.

(According to instructions on page 110.)

White discharge:
Hyraldite A.

White discharge:
Hyraldite A.

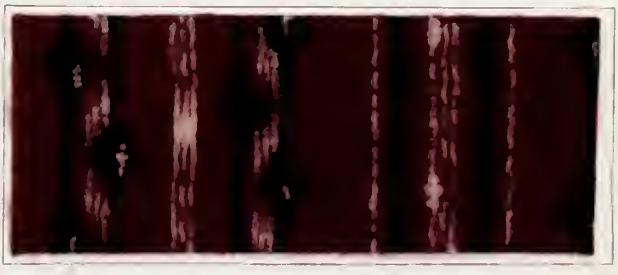
White discharge:
Hyraldite W.



White discharge:
Hyraldite W.

White discharge:
Hyraldite W.

Black:
Aniline Black.



Paranitraniline Red discharged with Hyraldite pat.

(According to instructions on page 110.)

White discharge:
Hyraldite W.

Black:
Aniline Black.

Yellow discharge:
Oxy Diamine Yellow T Z
with Hyraldite A.
(Details on page 65.)

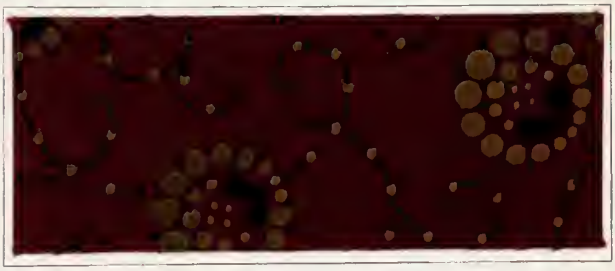
White discharge:
Hyraldite W.

Blue discharge:
New Methylene Blue NSS
with Hyraldite A.
(Details on page 63.)

White discharge:
Hyraldite W.

Yellow discharge:
Thioflavine T
with Hyraldite A.
(Details on page 63.)

Black:
Aniline Black.



Green discharge:
Thioflavine T and
New Methylene Blue NSS
with Hyraldite A.
(Details on page 63.)

White discharge:
Hyraldite W.

Paranitraniline Red dyed on Goods previously printed with Aniline Black.

The important black and red style is produced to best advantage as follows: Boiled-off or bleached goods are first printed with Aniline Black, taken through the Mather & Platt, and without rinsing passed through ammonia vapours in order to neutralise the acid. They are then impregnated with Beta Naphtol (page 99) and developed with Paranitraniline C or Nitrazol C as described on page 108, rinsed, soaped, and finished off.

Previously printed with Aniline Black,
then dyed with Paranitraniline Red.

It is not so advantageous to print the Aniline Black on the developed Red, as the goods will then have to be subjected to an additional washing and drying, and the steamed Red will consequently turn out less bright.

Paranitraniline Brown.

(Para Brown or Ice Brown.)

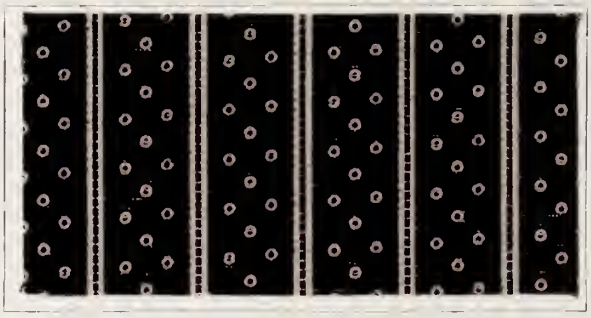
Browns of very good fastness to washing and light, but not fast to perspiration, are obtained by the action of copper combinations on Paranitraniline Red.

Such Browns are produced:

a) By aftertreating the ready Paranitraniline Red with sulphate of copper,

b) by adding copper compounds to the Naphtol or diazo solutions.

The aftertreatment of the Red with sulphate of copper is carried out very easily by turning the dyed goods in a bath of 70° C. (160 deg. F.) containing 8 oz sulphate of copper per 10 gallons liquor.



Paranitraniline Brown,
produced by direct printing with Paranitraniline C and
aftertreating with sulphate of copper.

This method is simpler than the one necessitating the addition of copper combinations to the Naphtol and diazo solutions, and applicable for

Red, printed direct,
reserved Red,
discharged Red,
plain Red, and Red dyed on previously printed goods.

Of course no colours likely to be impaired by an aftertreatment with sulphate of copper should be used alongside of the Red to be thus treated.

When working with the addition of a copper solution to the Naphtol prepare, the procedure is as follows:

I. 7 1/2 lbs of cupric chloride solution of 75° Tw.,
3 1/2 „ „ tartaric acid powder and
3 „ „ glycerine of 48° Tw. are gradually added to
9 „ „ caustic soda lye of 75° Tw. diluted with
12 1/2 „ „ water.

II. 2 1/2 lbs of Beta Naphtol are mixed to a paste with
4 „ „ warm water, then dissolved with
6 „ „ caustic soda lye of 75° Tw. and
44 1/2 „ „ cold water, and
7 1/2 „ „ Turkey-red oil or castor-oil soap are added.

100 lbs or 10 gallons (approx.)

Solution I is poured into Solution II.

For printing, one of the print colours with Paranitraniline C or Nitrazol C stated on pages 100 – 102 may be used. The further treatment is the same as for Red.

In a like manner the Brown may also be produced on this Naphtol preparation according to the details on page 107, by dyeing or padding, in which case sulphite of potash resists may be printed on the mordanted goods as described on page 104.

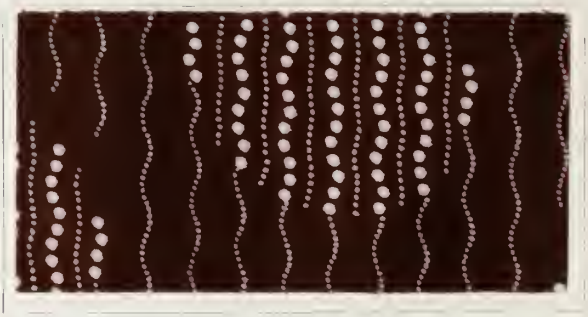
The Brown may likewise be produced by impregnating the fabric with the ordinary Naphtol preparation (page 99) or the cupric preparation described above, and then printing or padding with the diazo solution containing 1 gallon cupric chloride solution of 75° Tw. per 25 gallons. The diazo solution however loses considerably in stability by the addition of sulphate of copper, which for this reason must not be added until immediately before use.

Para-Bistre.

Very fine brown shades which are easily discharged with Hyraldite may be obtained by the reaction of diazotised Paranitraniline C or Nitrazol C on Chrysoïdine or Bismarck Brown. With the former reddish, and with the latter more yellowish, shades of Brown are obtained.

The bleached goods are padded with the following solution in the padding machine:

1 1/2–3 lbs of Chrysoïdine crystals A G or Bismarck Brown G G are dissolved in
2 1/2–5 „ „ acetic acid of 8° Tw. and
40 „ „ hot water;
5 „ „ tragacanth solution 65:1000 are then added, and by the addition of water the whole is brought up to
10 gallons.



Padded with Bismarck Brown G G
Coupled with Nitrazol C pat.
Discharged with Hyraldite A pat.

Padded with Chrysoïdine A G crystals
Coupled with Nitrazol C pat.
Discharged with Hyraldite A pat.

The padded goods are dried in the manner described for the Beta Naphtol preparation (page 100) in a hot-flue or a cylinder drying machine, the first cylinders of which are covered with cloth, and then coupled with a solution of diazotised Paranitraniline C or Nitrazol C.

To enable the coupled shade to attain its full depth, sufficient time must be allowed for the developing during the air passage which follows the coupling.

The goods are finally rinsed well, soaped if necessary, then rinsed again, and dried.

As already mentioned, the brown dyeings may be very easily and perfectly discharged white and in colours by means of Hyraldite. Discharging is done as described for Diamine Colours on page 61.

The above patterns have been produced in this manner.

V.

Acid Colours.

On account of their brilliancy and good fastness to light some of the acid colours are largely used in calico printing, although they cannot be fixed fast to washing.

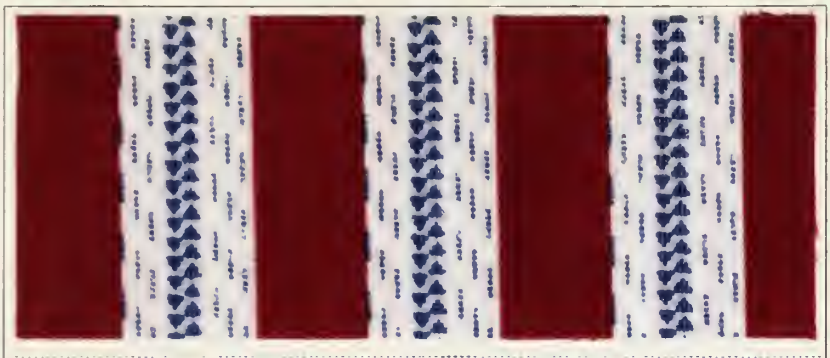
Those used most frequently are Scarlet FR, F2R, F3R, Brilliant Croceïne B and M and Brilliant Cochineal 4R, the latter especially for bluish shades of Pink, the method used being as follows:

The dyestuff is first dissolved in water and then added to the thickening, thereupon the acetic acid and acetate of alumina are added.

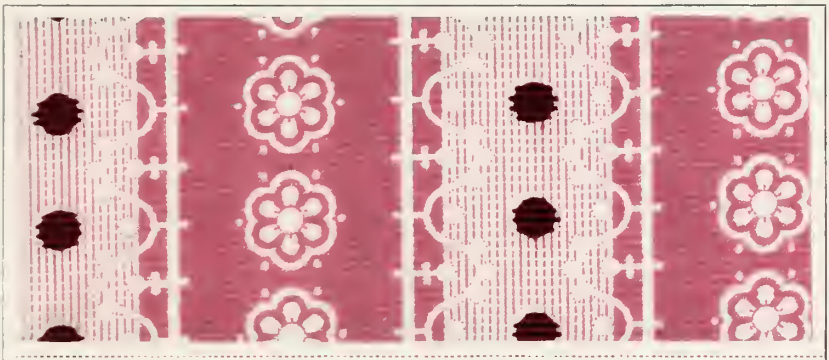
1 – 3½ lbs of dyestuff are dissolved in
16 „ „ warm water and stirred into
59½ „ „ starch tragacanth thickening TEO; then
10 – 16 „ „ acetate of alumina of 18° Tw. and
5 „ „ acetic acid are added.

100 lbs or 10 gallons (approx.)

After printing and drying, steam for ½ hour without pressure, and then finish the back of the goods without previous washing.



Red: Scarlet F2R.
Blue: Diamine Sky Blue pat.



Pink: Brilliant Cochineal 4R.
Red: Brilliant Croceine M00.

Red Brilliant Croceine M00.

VI.

Aniline Black Style.

Coloured Reserves under Aniline Black.

For printing coloured reserves under Aniline Black, the following groups of dyestuffs are principally used:

A. Basic Colours.
B. Immedial Colours.
C. Diamine Colours.

A. Reserves with Basic Colours.

The basic colours above all are especially well suited for this style on account of their brightness.

The following methods are usually employed for fixing them:

1. The pieces are prepared with the Aniline Black pad given below, and printed with the basic colours without any further fixing agent.

Aniline Black Pad.

I. 29 lbs of aniline salt and
1½ „ „ tannin are dissolved and brought up to
10 gallons.

II. 18½lbs of ferrocyanide of potassium are dissolved and brought up to
10 gallons.

III. 9½lbs of chlorate of soda are dissolved and brought up to
10 gallons.

Solutions I, II and III are mixed cold in equal parts.

The coloured resists are prepared as follows:

Yellow: 1 oz of Thioflavine T
5 „ „ acetic acid
8 „ „ acetate of soda
20 „ „ thickening AS *.

* Thickening AS.
1½lbs of antimony salt, finely powdered, are dissolved in
15 „ „ water and stirred to a paste with
5 „ „ British gum 1:1.

Other basic colours are applied in a like manner, for instance for

Blue:	New Methylene Blue NSS pat. Methyl Violet BB 72 No. 1.
Red:	Irisamine G pat., Rosazeïne 6G Thioflavine T pat.
Pink:	Irisamine G pat., Rosazeïne 6G.
Green:	Brilliant Green crystals extra Thioflavine T pat.
Lilac:	Tannin Heliotrope New Methylene Blue NSS pat. Methyl Violet BB 72 No. 1.
Brown:	Aniline Yellow.

For white resists the sulphite of potash resist described on page 105 is used.

After printing and drying, the goods are given a short steaming in a small Mather & Platt, taken in the open width through a bath containing 8 oz chromate of potash and 8 oz soda per 10 gallons, and rinsed.

2. The goods are padded with the Aniline Black pad described on page 121, omitting however the tannin, then printed with a zinc white resist containing basic colours, and steamed in a small Mather & Platt.

The basic colours are fixed by the ferrocyanide of zinc which forms during the steaming.

The coloured resists are prepared as follows:

4 1/2 lbs	of dyestuff are dissolved in
9 „	„ acetic acid, then stirred into
32 1/2 „	„ starch tragacanth thickening, to which when cold
54 „	„ White Z * are added.
100 lbs	or 10 gallons (approx.)

* White Z.

30 lbs	of thickening O †
25 „	„ zinc white
35 „	„ acetate of soda
10 „	„ tin crystals.
100 lbs	or 10 gallons (approx.)

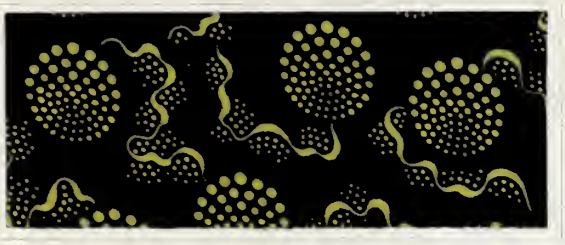
† Thickening O.

12 lbs	of wheat starch
66 1/2 „	„ water
8 „	„ acetic acid
12 „	„ tragacanth 65:1000
1 1/2 „	„ olive oil.
100 lbs	or 10 gallons (approx.)

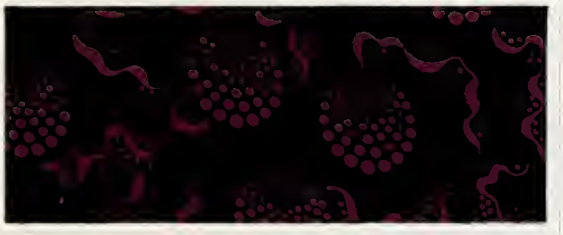
The dyestuffs mentioned under No 1 are also adapted for this method, the goods also being finished off in the same manner as described above.

For white resists the sulphite of potash reserve described on page 105 is also used.

The following patterns have been produced in this manner.



Thioflavine T pat.



Rosazeïne 6G.

White: Sulphite of potash.
Pink: Rosazeïne 6G.
Green: { Thioflavine T pat.
Brilliant Green crystals extra.

B. Reserves with Immedial Colours.

Of the Immedial Colours, the various brands of Immedial Black printed in combination with Hyraldite on an undeveloped Aniline Black bottom are specially well suited for the production of grey resists possessing exceedingly good fastness to light and washing, Hyraldite thereby acting as a reserve (compare the third pattern of Table XI).

The print colour is prepared approximately as follows:

I. 6 parts by weight of Immedial Black are heated with
40 „ „ „ „ bisulphite of potash of 70° Tw. to 60–70° C. (140–160 deg. F.); then
70 „ „ „ „ Hyraldite solution 1:1 and
134 „ „ „ „ water are added, and the colour is cooled off completely.

II. 500 parts by weight of British gum 1:1 and
150 „ „ „ „ potash are dissolved warm in
100 „ „ „ „ water, stirred to a paste, and cooled off.

1000 parts (approx.)

After printing and drying, the goods are steamed for a few minutes as dry as possible in the Mather & Platt and then finished off in the manner customary for Aniline Black.

The print colours do not affect the copper rollers.

The following brands of Black are especially adapted for printing:

Immedial Black NN conc.
Immedial Black NBB conc.
Immedial Black NNG conc.
Immedial Black V extra.

C. Reserves with Diamine Colours.

The Diamine Colours may also serve as coloured resists under Aniline Black when printed together with acetate of soda on the fabric padded with ferrocyanide of Aniline Black padding solution.

The resist is composed as follows:

1– 2 lbs of Diamine Colours are dissolved in
33 „ „ warm water; add
10 „ „ glycerine and
1– 2 „ „ phosphate of soda, stir the solution to a paste with
38 „ „ British gum, boil, and when cold add
15 „ „ acetate of soda,

100 lbs or 10 gallons (approx.)

After printing, the goods are passed through a small Mather & Platt and then through a bath of chromate and carbonate of soda, thereupon rinsed, and dried.

Conversion Effects with Diamine Colours and Aniline Black.

Very handsome effects may be obtained by printing a reducing discharge on a fabric dyed with Diamine Colours, and then an Aniline Black colour to which basic colours resistant to the discharge have been added.

The Aniline Black is reserved at the discharged parts so that the basic colour becomes visible.

This method was first recommended by Pluzanski in combination with tin crystals discharge and is of late being very successfully applied with Hyraldite W in place of the less advantageous tin crystals discharge.

Any of the Diamine Colours dischargeable with tin crystals or Hyraldite may be applied for this article, and on the other hand those basic colours which resist these discharges.

The fabric is first dyed with the Diamine Colours and then printed with discharges of the following composition:

Hyraldite Discharge.

2 – 4	lbs	of Hyraldite W and
1/2 – 1	„	„ acetate of soda are stirred to a paste with
7 1/2 – 5	„	„ neutral starch tragacanth thickening, heated for about 1/4 hour to 70° C. (160 deg. F.); stirred until cold, and passed through a
10 lbs (approx.)		fine sieve.

Tin Crystals Discharge.

13	lbs	of tragacanth solution 65:1000,	are thoroughly mixed;
11	„	„ tartaric acid,	
10	„	„ water,	
5	„	„ potash and	
7 1/2	„	„ caustic soda lye of 75° Tw.	
		then	
19	„	„ tragacanth solution mixed with	
13 1/2	„	„ tin crystals are added and thereupon	
7	„	„ soda ash,	
12	„	„ acetate of soda,	
1	„	„ olive oil and	
1	„	„ turpentine oil.	
100	lbs	or 10 gallons (approx.)	

Coloured Discharges.

Aniline Black and Pink.

71 lbs of Aniline Black thickening
2 „ „ Rosazeïne 6 G
7 „ „ glycerine
20 „ „ aniline solution.
100 lbs or 10 gallons (approx.)

Aniline Black and Yellow.

74 lbs of Aniline Black thickening
1 1/2 „ „ Thioflavine T
4 1/2 „ „ glycerine
20 „ „ aniline solution.
100 lbs or 10 gallons (approx.)

Aniline Black and Blue.

68 lbs of Aniline Black thickening
2 „ „ New Methylene Blue N
6 „ „ acetic acid of 8° Tw.
4 „ „ glycerine
20 „ „ aniline solution
100 lbs or 10 gallons (approx.)

Aniline Black and Green.

a) When using Hyraldite discharge:

1 lb of Aniline Black and Yellow
1/2 „ „ Aniline Black and Blue.

b) When using Tin Crystals discharge:

Same as with Aniline Black and Blue, substituting Brilliant Green crystals extra for New Methylene Blue N.

Aniline Black Thickening.

5 lbs of wheat starch
26 „ „ burnt starch
52 „ „ water
2 1/2 „ „ chlorate of soda
6 „ „ water
2 1/2 „ „ ferrocyanide of potassium
6 „ „ water.
100 lbs or 10 gallons (approx.)

Aniline Solution.

1 part aniline oil
1 „ hydrochloric acid of 32° Tw.

After printing, the goods are passed for 3 minutes through a Mather & Platt, then rinsed and lightly soaped.

VII.

Thickenings, Mordants and Tables.

Thickening Agents.

Starch.

Starch is contained in many different kinds of plants and is gained principally from wheat grains, potatoes, Indian corn and rice. The origin of the starch is best identified by means of a microscope.

Air-dried starch contains not more than 0,6% mineral and 18% water. Wheat starch is the least and potato starch the most apt to absorb moisture. Moist starch, as for instance "green" starch, containing 35 per cent or more of water, becomes after a short time unfit for use. When dried at 212 deg. F. it must still remain as a very fine powder and must not become pasty (in the latter case the starch would contain an excessive quantity of water).

In water of 50° C. (120 deg. F.) the starch begins to swell, and between 60–87° C. (140–190 deg. F.) it is converted into paste. The paste is apt to become sour through lactic fermentation, being thereby rendered unfit for use. The value of the starch is determined by the stability and thickening property of the paste.

By treatment with dilute acids or by heating to 200–260° C. (390–500 deg. F.), starch is converted into dextrine. By the action of diastase (malt) it is turned into dextrine and maltose. Through the action of caustic soda lye it is converted into apparatine, which is sometimes used for thickenings, especially however as a finish.

For the production of thickenings, the starch is stirred to a paste with a little water, the remainder of the water then added, the solution gradually brought to the boil and boiled for 15–20 minutes.

If boiling is continued too long, the starch paste will turn thinner again and lose its thickening power.

Wheat Starch.

Of all the different kinds of starch, wheat starch is most largely used as a thickener. It possesses very strong thickening power, and the print colours prepared therewith penetrate the material well.

Wheat starch must be free from any bran which is very apt to block the engraved parts. Bran may be detected by stirring the finely ground starch to a thin, even, milky fluid and then passing through a very fine hair sieve; the bran will then remain in the sieve.

Maize Starch

possesses still greater thickening power than wheat starch, but does not keep so well. Although specially well adapted for alkaline print colours and discharge colours, its chief application is for finishing purposes.

Rice Starch

is sometimes used as a thickener in printing on flannelette, but its principal application is for finishing purposes. Unlike the other kinds of starch, it is marketed almost completely free from any sand.

Potato Starch

is chiefly used as a cheap substitute for the aforementioned qualities of starch for finishing purposes. It is but little adapted for thickening print colours.

Flour,

especially wheat flour, is sometimes used as a thickener, either by itself or in combination with wheat starch. Thickenings prepared in this manner do not keep so well as pure starch thickenings.

The flour must be as finely sifted as possible and free from any bran or mineral substance.

Dextrine

is prepared by heating starch, chiefly potato starch, with dilute acid, and is marketed as white and as yellow dextrine. White dextrine contains a good deal of the original starch in an unchanged condition, yellow dextrine on the other hand only very little. Both kinds further contain grape sugar and are sometimes also adulterated with sand, gypsum, etc.

Good dextrine dissolves in cold water with but little residue and must not give an acid reaction.

Dextrine has only one-fifth to one-sixth the thickening power of wheat starch, but on the other hand the print colours prepared with it are much smoother than those containing wheat starch.

Burnt Starch

is obtained by roasting starch, by which process the insoluble starch is partially converted into soluble dextrine. The various products turn out paler or darker according to the degree of roasting they have been submitted to.

The quality of burnt starch is determined by its colour and thickening power as well as the proportion of water it contains (which should not exceed 4 %).

British Gum

is burnt maize starch and is marketed in form of a brownish powder. It is an excellent thickener and can in many cases be used as a substitute for the more expensive ordinary gums. The colours produced therewith level very well; British gum is also specially well adapted for chlorate discharges and reserves, both for the Prud'homme article and for colours requiring a caustic alkaline discharge.

Leiogomme

is roasted potato starch and is specially well adapted for colours requiring a strong caustic alkaline discharge.

Gum.

The ordinary gums (Arabic Gum, Senegal Gum, etc.) are obtained from the juice of various kinds of acacias.

Good gum should be easily soluble in water and not be too dark in colour. Particular care should be taken that it does not contain any sand.

Gum solution must not become coloured when mixed cold with a little iodine; colouring red indicates that it contains dextrine, and blue that it contains starch.

Gum is specially adapted for printing pale shades in large patterns.

Crystal Gum, Slab Gum, Indian Gum, Gomme Labiche.

Under these and similar designations there are a number of excellent substitutes for the ordinary gum (Arabic, Senegal etc.) on the market which are prepared by dissolving certain insoluble kinds of gum by special methods.

They consist of light yellow to dark crystalline lumps or slabs which are easily soluble in water and possess great thickening power. They are generally dissolved in equal quantities of warm water, but may be considerably more diluted.

These prepared gums are very economical and may in almost every case be used in place of the ordinary kinds of gum. They are also particularly distinguished by the absence of any kind of hard insoluble impurities.

Gum Tragacanth.

Tragacanth gum or tragacanth is derived from various kinds of astragalus and are marketed either in form of flat yellowish-white pieces as leaf tragacanth, or in a bent worm-like shape as worm tragacanth.

Tragacanth is difficult to pulverise and should be free from any sand. It differs from ordinary gum in so far that in cold water it does not dissolve, but only swells up.

In preparing the thickening, the tragacanth is soaked for about 48 hours in the proportion of 6–10 lbs per 10 gallons water and then boiled for several hours until a uniform mucilage is obtained. By continued boiling it becomes more soluble, but less mucous.

The thickening property of tragacanth is about double that of wheat starch; the thickening however easily becomes sour. On the other hand, acid starch thickening keeps better with the addition of tragacanth solution than without. Starch colours containing tannin also require an addition of tragacanth; starch tragacanth thickening is thus one of the thickeners most frequently employed. By itself, tragacanth however comes into consideration almost exclusively for printing ice and padding colours.

Blood Albumen.

Blood albumen is sold in the form of light yellow to brown scales of a bright appearance which are soluble in water at a temperature not exceeding 35° C. (95 deg. F.). At about 70° C. (160 deg. F.) it becomes insoluble and coagulates. When cold it coagulates by means of mineral acids, metaphosphoric acid and certain metallic salts. The lighter sorts of blood albumen are to be given the preference over the darker ones, particularly when printing pale shades.

The albumen solution is prepared by pouring 1—2 parts water of 30° C. (85 deg.F.) over about 1 part albumen, allowing the mixture to stand for about 24 hours, and from time to time submerging the albumen swimming on the surface. The solution is then separated by sieving it off from the undissolved residue. To prevent the solutions from becoming putrid, a little arsenate of soda (1—2%), glycerine etc. may be added.

Blood albumen serves principally as a thickener and as a fixing agent for earth colours, Diamine Colours and sometimes also for basic colours. To prevent the foaming of the albumen colours, some olive oil or turpentine oil is added, and the colours are printed with a rotating brush, as they are apt to block the engraved parts of the printing rollers.

The unpleasant odour frequently attaching to goods printed with albumen colours may easily be removed by chloring slightly after the steaming.

Egg Albumen

is marketed in form of pale yellow scales and on account of its light colour is in certain cases given the preference over blood albumen in spite of its high price. Their general properties are the same, but the thickening property of egg albumen is inferior to that of blood albumen.

Glue.

Glue should be as colourless as possible. By adding it to the dyebath, a purer white may be obtained, particularly in the case of the tannin discharge article. It is also used to a considerable extent in finishing.

Thickenings.

Gum Thickening 1:1.

1 part by weight of Senegal gum (crystal etc. gum) and
1 „ „ „ „ water are boiled together.

Tragacanth Thickening 65:1000.

65 parts by weight of tragacanth are
495 „ „ „ „ soaked in water for 48 hours;
500 „ „ „ „ water are then added, and the whole is boiled until a smooth mucilage results.
1000 parts (approx.)

Starch Tragacanth Thickening T.

(Thickening T.)

115 parts by weight of wheat starch,
705 „ „ „ „ water,
100 „ „ „ „ tragacanth thickening 65:1000 and
80 „ „ „ „ acetic acid of 8° Tw. are boiled together.
1000 parts (approx.)

Starch Tragacanth Thickening TEO.

(Thickening TEO.)

100 parts by weight of wheat starch,
590 „ „ „ „ water,
200 „ „ „ „ tragacanth thickening 65:1000
90 „ „ „ „ acetic acid of 8° Tw. and
20 „ „ „ „ olive oil are boiled together.
1000 parts (approx.)

Starch Tragacanth Thickening TO.

(Thickening TO.)

110 parts by weight of weath starch,
660 „ „ „ „ water,
200 „ „ „ „ tragacanth 65:1000 and
30 „ „ „ „ olive oil are boiled together.
1000 parts (approx.)

Starch Tragacanth Thickening O.

(Thickening O.)

120 parts by weight of wheat starch,
665 „ „ „ „ water,
80 „ „ „ „ acetic acid of 8° Tw.,
120 „ „ „ „ tragacanth 65:1000 and
15 „ „ „ „ olive oil are boiled together.

1000 parts (approx.)

Starch Tragacanth Thickening N.

(Thickening N.)

100 parts by weight of wheat starch,
350 „ „ „ „ water and
550 „ „ „ „ tragacanth 65:1000 are boiled together

1000 parts (approx.)

Starch Tragacanth Thickening for Hyraldite Discharges.

100—120 parts by weight of wheat starch,
490—470 „ „ „ „ water,
400 „ „ „ „ tragacanth 65:1000 and
10 „ „ „ „ glycerine are boiled together.

1000 parts (approx.)

Thickening M.

200 parts by weight of wheat flour,
500 „ „ „ „ water and
300 „ „ „ „ tragacanth 65:1000 are boiled together.

1000 parts (approx.)

British Gum Thickening 1:1.

1 part by weight of British gum and
1 „ „ „ „ water are boiled together.

Thickening JM.

330 parts by weight of British gum are heated with
330 „ „ „ „ gum 1:1,
310 „ „ „ „ water and
30 „ „ „ „ Turkey-red oil.

1000 parts (approx.)

Thickening AS.

150 parts by weight of antimony salt, finely powdered, are dissolved in
1500 „ „ „ „ water and stirred to a paste with
500 „ „ „ „ British gum.

Dextrine Thickening.

1 part by weight of dextrine is dissolved in
1 „ „ „ „ water.

Blood Albumen Solution 1:1.

100 parts by weight of blood albumen are dissolved in
100 „ „ „ „ water of about 85 deg. F. (page 132).

Blood Albumen Solution 1:2.

95 parts by weight of blood albumen are dissolved in
200 „ „ „ „ water of about 85 deg. F. (page 132) and mixed with
5 „ „ „ „ turpentine oil.

Egg Albumen Solution 1:1.

1 part by weight of egg albumen is dissolved in
1 „ „ „ „ water of 85 deg. F. (page 132).

Thickening AlT.

430 parts by weight of blood albumen solution 1:1 are mixed with
570 „ „ „ „ tragacanth 65:1000.

1000 parts (approx.)

Glue Solution.

500 parts by weight of glue are soaked in
250 „ „ „ „ water and
250 „ „ „ „ acetic acid of 8° Tw. added;
the whole is heated until solution sets in and brought again to

1000 parts by weight by the addition of dilute acetic acid.

Discharges and Mordants.

Hyraldite A 1:1.

1 part by weight of Hyraldite A is heated in the water bath with
1 „ „ „ „ water until complete solution sets in.

Acetate of Tin (Protoxide) of 28° Tw.

10 lbs protoxide of tin hydrate paste (see below) are dissolved in
1–1 1/2 gallons acetic acid of 8° Tw. and diluted with water to 28° Tw.;

or:

2 lbs tin crystals are dissolved in
14 oz water and stirred into the hot solution of
3 lbs sugar of lead in
2 „ water and
3 1/2 oz acetic acid of 8° Tw.; when cold, the clear fluid is drawn off the precipitate and brought with water up to 28° Tw.

The solutions do not keep very long.

For other tin discharges see pages 36 and 69–71.

Protoxide of Tin Hydrate Paste

is prepared as follows:

10 lbs tin crystals are dissolved in
4 gallons water and precipitated with
0,7 „ ammonia; the temperature should not exceed 45° C. (115 deg. F.).

The precipitate is washed out several times by decanting with water and pressed off until it contains about 50% of dry matter.

The paste oxidises fairly rapidly.

Zinc Dust Discharge.

See page 73.

Chlorate Discharge.

See page 35.

Tannin-Acetic Acid 1:1.

1 lb tannin is dissolved in
1 „ acetic acid of 8° Tw.

Cuprous Sulphide.

30 lbs sulphate of copper are dissolved in
40 gallons water and at a temperature of 50° C. (122 deg. F.) mixed with a solution of
30 lbs sodium sulphide crystals in
12 gallons water.

The resulting precipitate is filtered off, washed 2 or 3 times with cold water, and pressed off to about 50 parts.

The paste oxidises rather quickly.

Vanadium Solution.

1 oz vanadiate of ammonia,
8 „ distilled water,
5 „ hydrochloric acid of 32° Tw. and
1/2 „ glycerine are boiled together for about 1/4 hour until the solution has turned blue, then
8 lbs distilled water are added.

Ferricyanide of Ammonia of 42° Tw.

10 lbs ferricyanide of potassium (red prussiate of potash) and
7 „ sulphate of ammonia crystals are dissolved in
20 „ boiling water and allowed to cool off.

The clear solution is then decanted from the crystallised potassium sulphate and made up with water to 42° Tw.

Acetate of Alumina of 18° Tw.

475 parts by weight of alum,
405 „ „ „ „ sugar of lead and
1000 „ „ „ „ water.

Acetate of Lime of 28° Tw.

100 parts by weight of caustic lime,
350 „ „ „ „ water and
600 „ „ „ „ acetic acid of 8° Tw.

Acetate of Chrome of 36° Tw.

800 parts by weight of chrome-alum,
530 „ „ „ „ sugar of lead and
1000 „ „ „ „ water.

Chrome Solution C.

125 parts by weight of chrome-alum are dissolved in
615 „ „ „ „ water.
Into the cold solution a mixture of
250 „ „ „ „ caustic soda lye of 75° Tw. and
10 „ „ „ „ glycerine is then rapidly stirred.

Chlorate of Chrome of 32° Tw.

60 lbs chrome-alum are precipitated in
80 „ hot water with
20 „ soda ash in
60 „ water.
The precipitate is well washed with warm water and slowly mixed with
10 „ sulphuric acid of 170° Tw.; then
22 „ chlorate of potash dissolved in
50 „ water are added, the mixture being stirred well, left standing for a few days, and filtered off.

Antimony Paste.

30 lbs antimony salt are dissolved in
50 „ water and mixed with
30 „ soda ash in
75 „ water, then filtered off and pressed.
A paste is obtained corresponding in weight to about one-sixth of this mixture.

Oxalate of Ammonia.

1 lb oxalic acid is dissolved in
1 gallon water and neutralised with approx.
1 lb 2 oz ammonia of 0,913 spec. gravity.

Citrate of Ammonia of 36° Tw.

1 lb citric acid powder are dissolved in
1 „ ammonia of 0,913 spec. gravity and brought with water up to 36° Tw.
The solution should be neutral.

Tartrate of Ammonia of 36° Tw.

1 lb tartaric acid powder is dissolved in
1 „ water and mixed with approximately
15 7/8 oz ammonia of 0,913 spec. gravity until a weakly alkaline reaction sets in. The solution is brought up to 36° Tw.

Castor-oil Soap.

10 lbs castor-oil first quality (obtained from the first pressing) are stirred well with
8 1/2 „ caustic soda lye of 36° Tw., and boiled for 1 hour; after about 5 hours, when the soap has cooled off to some extent,
2 „ 3 oz hydrochloric acid of 32° Tw. are added; the mixture is then boiled for another 1/2 hour, allowed to cool, and the solution of common salt poured off.

Tables of the Specific Gravities of Acids and Alkaline Lyes.

Sulphuric Acid.

Specific Gravity of Sulphuric Acid at 59° F.
(Lunge and Isler).

Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid
2	1.57	48	32.28	94	56.90	140	77.17
4	3.03	50	33.43	96	57.83	142	78.04
6	4.49	52	34.57	98	58.74	144	78.92
8	5.96	54	35.71	100	59.70	146	79.80
10	7.37	56	36.87	102	60.65	148	80.68
12	8.77	58	38.03	104	61.59	150	81.56
14	10.19	60	39.19	106	62.53	152	82.44
16	10.90	62	40.35	108	63.43	154	83.32
18	12.99	64	41.50	110	64.26	156	84.50
20	14.35	66	42.66	112	65.08	158	85.70
22	15.71	68	43.74	114	65.90	160	86.90
24	17.01	70	44.82	116	66.71	162	88.30
26	18.31	72	45.88	118	67.59	164	90.05
28	19.61	74	46.94	120	68.51	165	91.00
30	20.91	76	48.00	122	69.43	166	92.10
32	22.19	78	49.06	124	70.32	167	93.43
34	23.47	80	50.11	126	71.16	168	95.60
36	24.76	82	51.15	128	71.99	168.3*	97.70
38	26.04	84	52.15	130	72.82	168.1*	98.70
40	27.32	86	53.11	132	73.64	168*	99.20
42	28.58	88	54.07	134	74.51	167.7*	99.95
44	29.84	90	55.03	136	75.42		
46	31.11	92	55.97	138	76.30		

*) Sulphuric acid of 97,70% has the highest specific gravity, whilst that of stronger acid is a little lower.

Hydrochloric Acid.

Specific Gravity of Hydrochloric Acid at 59° F.

(Lunge and Marchlewski).

Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid
1	1.15	11	11.18	21	20.97	31	30.55
2	2.14	12	12.19	22	21.92	32	31.52
3	3.12	13	13.19	23	22.86	33	32.49
4	4.13	14	14.17	24	23.82	34	33.46
5	5.15	15	15.16	25	24.78	35	34.42
6	6.15	16	16.15	26	25.75	36	35.39
7	7.15	17	17.13	27	26.70	37	36.31
8	8.16	18	18.11	28	27.66	38	37.23
9	9.17	19	19.06	29	28.61	39	38.16
10	10.17	20	20.01	30	29.57	40	39.11

It will be noticed that each degree Twaddle indicates approximately 1% pure hydrochloric acid.

Acetic Acid.

Specific Gravity of Acetic Acid at 59° F.

(Oudemans).

Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle
5	1.3	25	7.0	45	11.4	65	14.3	85	14.8
10	2.8	30	8.2	50	12.3	70	14.7	90	14.3
15	4.3	35	9.4	55	13.1	75	14.9	95	13.2
20	5.7	40	10.5	60	13.7	80	15.0	100	11.1

The specific gravities above 11° Tw. correspond to two liquids of different strengths. To ascertain whether the acid contains more or less than 77% pure acetic acid, a small quantity of water should be added after measuring; if, on again measuring, a higher specific gravity is found, the acid contains more than 77%, otherwise less.

Caustic Soda Lye.

Specific Gravity of Caustic Soda Lye at 59° F. (Schiff and Gerlach).

Per cent Sodium Hydroxide	Degrees Twaddle	Per cent Sodium Hydroxide	Degrees Twaddle	Per cent Sodium Hydroxide	Degrees Twaddle
1	2.4	21	47.2	41	89.4
2	4.6	22	49.4	42	91.5
3	7.0	23	51.6	43	93.6
4	9.2	24	53.8	44	95.6
5	11.8	25	55.8	45	97.6
6	14.0	26	58.0	46	99.8
7	16.2	27	60.0	47	101.6
8	18.4	28	62.0	48	103.8
9	20.6	29	64.2	59	105.8
10	23.0	30	66.4	50	108.0
11	25.2	31	68.6	51	110.0
12	27.4	32	70.2	52	112.0
13	29.6	33	72.6	53	114.0
14	31.8	34	74.8	54	116.0
15	34.0	35	76.8	55	118.2
16	36.2	36	79.0	56	120.2
17	38.4	37	81.0	57	122.2
18	40.4	38	83.0	58	124.4
19	42.6	39	85.2	59	126.6
20	45.0	40	87.4	60	128.6

Ammonia (Ammonia Liquor).

Specific Gravity of Ammonia (Ammonia Liquor) at 59° F. (Lunge and Wiernik).

Specific gravity at 59° F.	Per cent (gaseous) ammonia	Specific gravity at 59° F.	Per cent (gaseous) ammonia	Specific gravity at 59° F.	Per cent (gaseous) ammonia
1.000	0.00	0.960	9.91	0.920	21.75
0.995	1.15	0.955	11.34	0.915	23.36
0.990	2.31	0.950	12.74	0.910	24.99
0.985	3.55	0.945	14.22	0.905	26.65
0.980	4.80	0.940	15.63	0.900	28.33
0.975	6.05	0.935	17.12	0.895	30.03
0.970	7.31	0.930	18.64	0.890	31.75
0.965	8.59	0.925	20.18	0.885	33.68

Solution of Sodium Carbonate.

Specific Gravities of Solutions of Sodium Carbonate at 59° F.

Degrees Twaddle	Per cent Sodium carbonate	Degrees Twaddle	Per cent Sodium carbonate	Degrees Twaddle	Per cent Sodium carbonate
1	0.47	11	5.23	21	9.90
2	0.95	12	5.71	22	10.37
3	1.42	13	6.17	23	10.83
4	1.90	14	6.64	24	11.30
5	2.38	15	7.10	25	11.76
6	2.85	16	7.57	26	12.23
7	3.33	17	8.04	27	12.70
8	3.80	18	8.51	28	13.16
9	4.28	19	8.97	29	13.63
10	4.76	20	9.43	30	14.09

Weights and Measures.

Hydrometer and Thermometer Tables.

I. Metric System.

1 metre (m) = 10 decimetres (dm) = 100 centimetres (cm) = 1000 millimetres (mm).
1 litre (l) = 1000 cubic centimetres (cc or ccm). 1 cubic metre (cbm) = 1000 litres.
1 gramme (g, gr or grm) = 10 decigrammes (dg) = 100 centigrammes (cg) = 1000 milligrammes (mg).
1 kilogramme (kg or kilo) = 1000 grammes.
1000 kilogrammes = 1 ton (t) i. e. metric ton.
100 kilogrammes = 1 metric centner or quintal.
50 kilogrammes = 1 centner (or nearly 1 hundredweight).
10 grammes = 1 dekagramme (deka or dg). 100 grammes = 1 hektogramme (hg).

The gramme is the standard unit of weight of the metric system and is equal to the weight of 1 cubic centimetre of pure water (measured whilst at its greatest density, in vacuum under a latitude of 45 degrees, at sea level). Hence the following relations of weights and measures are obtained:
1 cubic centimetre water = 1 gramme.
1 litre „ = 1 kilogramme.
1 cubic metre „ = 1 ton.

II. English Weights and Measures.

1 yard (yd) = 3 feet. 1 foot (') = 12 inches ("). 1 inch = 12 lines (''')
1 yard = 91.44 centimetres. 1 foot = 30.48 centimetres. 1 inch = 2.54 centimetres.
1 metre = 1.094 yards = 3.281 feet = 39.37 inches.
1 Imperial gallon (gall.) = 4 quarts (qts) = 8 pints (pts) = 32 gills.
1 Imperial gallon = 4.544 litres. 1 litre = 0.220 Imperial gallon.
1 pint = 0.568 litre. 1 litre = 1.76 pints.

In England by the term gallon (gall.) the Imperial gallon is meant, whilst in the United States of America the considerably smaller apothecary's or wine gallon is usually understood by this term. In England the ton or gross ton of 2240 lbs is also exclusively in use, whilst in the United States the term "ton" may refer either to the gross ton of 2240 lbs or the short ton of 2000 lbs avoir dupois. The weights and measures used in this book always refer to the Imperial gallon, and to the gross ton of 2240 lbs.

1 wine gallon = 4 quarts = 8 pints.
1 wine gallon = 3.785 litres. 1 litre = 0.264 wine gallon.
1 pint (apothecary's measure) = 0.473 litre. 1 litre = 2.114 pints (apothecary's measure).

1 Imperial gallon = 1.2 wine gallon. 1 wine gallon = 0.8335 Imperial gallon.
1 pound avoirdupois (lb) = 16 ounces (oz) = 256 drachms (drm).
1 pound avoirdupois approximately = 7000 troy grains (gr).

1 ton (gross ton) = 20 hundredweights (cwt) = 2240 lbs.
1 hundredweight = 4 quarters (28 lbs each) = 112 lbs.

1 ton = 1016 kilogrammes. 1 pound avoirdupois = 453.593 grammes.
1 ounce = 28.349 grammes. 1 troy grain = 0.065 grammes.
1 kilogramme = 2.205 lbs avoirdupois. 1 gramme = 15.434 troy grains.

1 Imperial gallon holds 10 pounds avoirdupois or 70000 grains water (measured at 62° F. under a barometric pressure of 30 inches).
1 wine gallon holds only 8.35 lbs water.

III. Russian Weights and Measures.

1 sagèn = 3 arshin = 7 feet.
1 foot = 12 inches. 1 arshin = 16 vershock.
1 foot = 30.48 centimetres. 1 inch = 2.54 centimetres. 1 Russian foot or inch equal to 1 English foot or inch respectively.
1 arshin = 71.12 centimetres. 1 vershock = 4.45 centimetres.
1 metre = 3.28 feet = 39.37 inches = 1.41 arshin = 22.50 vershock.

1 vedro = 8 stof = 12 quart = 30 krushki.
1 vedro = 12.30 litres. 1 stof = 1.54 litre. 1 quart = 1.02 litre.
1 litre = 0.0813 vedro = 0.9756 quart.

1 pood = 40 pounds (Russian). 1 pound = 32 lot = 96 solotnik.
1 pood = 16.38 kilogrammes. 1 kilogramme = 0.06 pood.
1 pound (Russian) = 409.51 grammes. 1 lot = 12.48 grammes. 1 solotnik = 4.16 grammes.
1 kilogramme = 2.44 pounds (Russian).

In Russian Poland the following weights and measures are used:

1 ell = 2 feet = 0.81 arshin = 12.96 vershock.
1 foot = 12 inches = 0.945 Russian foot = 11.34 Russian inches.
1 ell = 57.6 centimetres. 1 foot = 28.8 centimetres.
1 pound = 32 lots = 0.99 Russian pound = 405.50 grammes.
1 centner = 4 stone = 100 pounds = 2.476 pud.

Comparison of the Thermometer Tables of Celsius or Centigrade, Fahrenheit and Réaumur.

Degrees			Degrees			Degrees		
Celsius	Fahrenheit	Réaumur	Celsius	Fahrenheit	Réaumur	Celsius	Fahrenheit	Réaumur
0	32.0	0.0	34	93.2	27.2	68	154.4	54.4
1	33.8	0.8	35	95.0	28.0	69	156.2	55.2
2	35.6	1.6	36	96.8	28.8	70	158.0	56.0
3	37.4	2.4	37	98.6	29.6	71	159.8	56.8
4	39.2	3.2	38	100.4	30.4	72	161.6	57.6
5	41.0	4.0	39	102.2	31.2	73	163.4	58.4
6	42.8	4.8	40	104.0	32.0	74	165.2	59.2
7	44.6	5.6	41	105.8	32.8	75	167.0	60.0
8	46.4	6.4	42	107.6	33.6	76	168.8	60.8
9	48.2	7.2	43	109.4	34.4	77	170.6	61.6
10	50.0	8.0	44	111.2	35.2	78	172.4	62.4
11	51.8	8.8	45	113.0	36.0	79	174.2	63.2
12	53.6	9.6	46	114.8	36.8	80	176.0	64.0
13	55.4	10.4	47	116.6	37.6	81	177.8	64.8
14	57.2	11.2	48	118.4	38.4	82	179.6	65.6
15	59.0	12.0	49	120.2	39.2	83	181.4	66.4
16	60.8	12.8	50	122.0	40.0	84	183.2	67.2
17	62.6	13.6	51	123.8	40.8	85	185.0	68.0
18	64.4	14.4	52	125.6	41.6	86	186.8	68.8
19	66.2	15.2	53	127.4	42.4	87	188.6	69.6
20	68.0	16.0	54	129.2	43.2	88	190.4	70.4
21	69.8	16.8	55	131.0	44.0	89	192.2	71.2
22	71.6	17.6	56	132.8	44.8	90	194.0	72.0
23	73.4	18.4	57	134.6	45.6	91	195.8	72.8
24	75.2	19.2	58	136.4	46.4	92	197.6	73.6
25	77.0	20.0	59	138.2	47.2	93	199.4	74.4
26	78.8	20.8	60	140.0	48.0	94	201.2	75.2
27	80.6	21.6	61	141.8	48.8	95	203.0	76.0
28	82.4	22.4	62	143.6	49.6	96	204.8	76.8
29	84.2	23.2	63	145.4	50.4	97	206.6	77.6
30	86.0	24.0	64	147.2	51.2	98	208.4	78.4
31	87.8	24.8	65	149.0	52.0	99	210.2	79.2
32	89.6	25.6	66	150.8	52.8	100	212.0	80.0
33	91.4	26.4	67	152.6	53.6			

Comparison of Hydrometer Degrees Twaddle and Baumé with the Specific Gravities for Liquids heavier than Water.

Degrees Twaddle	Degrees Baumé	Specific Gravity	Degrees Twaddle	Degrees Baumé	Specific Gravity	Degrees Twaddle	Degrees Baumé	Specific Gravity
1	0.7	1.005	58	32.4	1.290	116	53.0	1.580
2	1.4	1.010	60	33.3	1.300	118	53.6	1.590
4	2.7	1.020	62	34.2	1.310	120	54.1	1.600
6	4.1	1.030	64	35.0	1.320	122	54.7	1.610
8	5.4	1.040	66	35.8	1.330	124	55.2	1.620
10	6.7	1.050	68	36.6	1.340	126	55.8	1.630
12	8.0	1.060	70	37.4	1.350	128	56.3	1.640
14	9.4	1.070	72	38.2	1.360	130	56.9	1.650
16	10.6	1.080	74	39.0	1.370	132	57.4	1.660
18	11.9	1.090	76	39.8	1.380	134	57.9	1.670
20	13.0	1.100	78	40.5	1.390	136	58.4	1.680
22	14.2	1.110	80	41.2	1.400	138	58.9	1.690
24	15.4	1.120	82	42.0	1.410	140	59.5	1.700
26	16.5	1.130	84	42.7	1 420	142	59.9	1.710
28	17.7	1.140	86	43.4	1.430	144	60.4	1.720
30	18.8	1.150	88	44.1	1.440	146	60.9	1.730
32	19.8	1.160	90	44.8	1.450	148	61.4	1.740
34	20.9	1.170	92	45.4	1.460	150	61.8	1.750
36	22.0	1.180	94	46.1	1.470	152	62.3	1.760
38	23.0	1.190	96	46.8	1.480	154	62.8	1.770
40	24.0	1.200	98	47.4	1.490	156	63.2	1.780
42	25.0	1.210	100	48.1	1.500	158	63.7	1.790
44	26.0	1.220	102	48.7	1.510	160	64.2	1.800
46	26.9	1.230	104	49.4	1.520	162	64.6	1.810
48	27.9	1.240	106	50.0	1.530	164	65.0	1.820
50	28.8	1.250	108	50.6	1.540	166	65.5	1.830
52	29.7	1.260	110	51.2	1.550	168	65.9	1.840
54	30.6	1.270	112	51.8	1.560	169	66.1	1.845
56	31.5	1.280	114	52.4	1.570	170	66.3	1.850

Note:

The degrees in Twaddle's hydrometer bear a direct relationship to the specific gravity and may be obtained from the same by the following formula, in which d represents the specific gravity and n the number of degrees Twaddle: $n = \frac{1000\ d - 1000}{5}$. On the other hand by the formula $d = \frac{5\ n + 1000}{1000}$ the degrees

Twaddle are converted into the corresponding specific gravity. For values below 2.0 the degrees Twaddle may also be obtained from the specific gravity by moving the decimal point two figures to the right, striking off the first figure and multiplying the rest by 2, as per the following example:

Specific gravity 1.133:
113.3:
13.3×2:
26.6° Twaddle.

Comparison of Hydrometer Degrees Baumé with the Specific Gravity of Liquids lighter than Water.

Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity
11	0.993	16	0.960	21	0.930	26	0.901
12	0.987	17	0.954	22	0.924	27	0.896
13	0.980	18	0.948	23	0.918	28	0.890
14	0.973	19	0.942	24	0.913	29	0.885
15	0.967	20	0.936	25	0.907	30	0.880

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